

CHEMICAL ABSTRACTS

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1—APPARATUS AND PLANT EQUIPMENT

W. L. BADGER

Progress in chemical equipment. ANON. *Ind. Eng. Chem.* 17, 1002-13(1925).—Mentions large stoneware tanks, Merco-Knight lubricated stoneware cocks, porous carboy stoppers, pressure-cast stoneware, industrial Pyrex equipment, general progress in enamel ware, rubber-lined centrifugal pumps, Alumite, Duriron double-acting pumps, use of welding in fabricating equipment, specially ventilated and non-ventilated motors, Shriver pressure diaphragm pumps, Hardinge clarifier-thickener, Dorr washer-thickener, use of thickeners for recovering blast-furnace flue dust, Hardinge batch mill, Sturtevant slow-speed air separator, Hardinge rotary classifiers, Krause rotating-disk spray driers, Carrier humidifiers for driers, spray burners for S. pressure plants for H_2SO_4 on the small scale, Schmiedel H_2SO_4 process for gases low in SO_2 , Bayer furnace for HCl, Badger-Stafford wood-distn. process, Badger horizontal film evaporator, Swenson-Pyrex glass evaporator, Swenson-Yaryan evaporator, evaporators for salts with inverted soly. curves, Swenson-Walker crystallizer and dewaterer, Swenson-Kipper drier, Buffalo atm. drum drier, Buffalo water distiller, Bethlehem-Frederking app. with coils cast in the walls, and the Carrier low-pressure refrigeration system.

W. L. BADGER

Apparatus from the laboratory. HANNES JOHN AND VIKTOR FISCH. *J. prakt. Chem.* 110, 279-82(1925); 3 cuts.—A simple and durable app. for the distn. of benzal acetone, or similar substances, with steam is described; also an app. for the recovery of H_2O by distn., and a sublimation app. consisting of a filter flask with attached funnel inverted in a dish. Suction is applied to the side-tube of the flask and Hz is prevented by a cotton wad in the tube.

J. H. MOORE

Recent additions to tools for research. ANON. *Ind. Eng. Chem.* 17, 1014-7(1925).—Mentions standardization to reduce no. of types carried in stock, quartz spectrograph, balance with light-beam pointer, adjustable-zero balance, new sub-stage condensers, Hg-vapor vacuum pumps, const.-temp. ovens, hardness testers, box-board testers, consistency and viscosity testers, chronoscope for psychological work, pipet for analyzing O_2 of high purity, lab. centrifuges, CO_2 n. lrs and other minor equipment.

W. L. BADGER

Filter cones of porous ceramic material. R. SCHWARZ. *Z. angew. Chem.* 38, 748(1925).—Disks for use in glass funnels. They filter rapidly, do not clog, are unaffected by acids and alkalis or sudden temp. changes. Made by W. Haldenwanger, Spandau.

J. H. MOORE

Quartz apparatus with inter-bottom. G. F. HÜTTIG AND HANS KÜENTHAL. *Chem.-Ztg.* 49, 716(1925).—A crucible of about 15 cc. capacity with perforated bottom, made by Schott & Gen. Cf. C. A. 18, 917, 1849; 19, 1829.

J. H. MOORE

Pressure-reducing valve. W. REINACHER. *Apparatus* 31, 233-4(1925).—The Zack-Weber, Werke valve for gas cylinders will not burn out.

J. H. MOORE

An apparatus for sublimation under reduced pressure. T. J. HEDLEY. *Chemistry & Industry* 44, 752(1925).—This app. is for use in the lab. and consists of a gas-heated brass temp. equalizer in which is mounted the boiling tube. The latter is surrounded in its upper part by a water jacket. In the upper part of the tube is a removable glass sleeve in which the sublimate is collected. The tube is stopped by a bung which is connected to the vacuum pump.

D. E. SHARP

A new polarizer. F. SÖBER. *Z. Krist.* 61, 315-7(1925).—A description of a polarizing prism made from an artificial crystal of $NaNO_3$ instead of Iceland spar. This was prepd. by the method of C. A. 19, 2892.

L. S. RAMSDELL

A universal X-ray spectrograph. A. MÜLLER. *J. Sci. Instruments* 2, 312-8(1925).—The article describes a compact form of X-ray spectrograph with which, by simple changes in the assembly, X-ray and crystal analysis by either Bragg, Laue, Debye or the revolving crystal method may be carried out.

D. E. SHARP

A micro-combustion bomb and micro-calorimeter. II. Appendix: abnormal combustion. W. A. ROTH AND R. LASSÉ. *Z. Elektrochem.* 30, 607-9 (1924).—The accuracy that can be attained by the use of the micro-calorimeter (C. A. 19, 2147) is increased by substituting for the usual Beckmann thermometer a specially constructed micro-thermometer. The "water value" of the micro-calorimeter was detd. by measuring the heat of combustion of 0.1 to 0.2 g. samples of benzoic acid supplied by the U. S. Bureau of Standards. The heats of combustion measured for 0.1 to 0.2 g. samples of "paraffinum liquidum" and salicylic acid were $10,964 \pm 2$ and 5241.5 ± 1.5 cal. per g., resp. The heat of combustion of benzoyl superoxide was found to be 6417 cal. per g. Uncertainties of 2% in this value can be explained by abnormal combustion, since 2 to 10 mg. of C were found deposited on the calorimeter cover after each detn.

R. L. DODGE.

An automatic blast lamp. E. F. ACKELSON AND C. C. KIPPLINGER. *J. Chem. Education* 2, 784 (1925). E. J. C.

Apparatus for determination of ferrous oxide. FRANZ MEYER. *Chem.-Ztg.* 49, 622 (1925); 1 cut.—A small cylindrical container with tube passing through lengthwise rises from the cork in the dissolving flask. The top end of the tube has a check-valve opening outward and from near the top, inside the container, an arm extends downward to near the bottom of the container which is filled with a satd. soln. of NaHCO_3 through a neck at the top. As the boiled soln. in the dissolving flask cools a little of the soln. is drawn over into it and the liberated CO_2 restores the equil.

J. H. MOORE

Laboratory note. J. H. VAN LINSCHOTEN. *Chem. Weekblad* 22, 325-6 (1925).—A simple shaking device is described for use in the colorimetric detn. of small quantities of I according to the method of von Fellenberg (C. A. 19, 1466).

B. J. C. v. H.

A practical filter for collecting small amounts of precipitates. ANON. *Z. angew. Chem.* 38, 724 (1925); 1 cut.—Description of the Boëtius filter.

J. H. MOORE

New design for apparatus to measure the coefficient of deviation from Boyle's law; and the determination of this coefficient for acetylene. J. T. HOWARTH AND F. P. BURT. *Trans. Faraday Soc.* (advance proof).—Improvements in the app. formerly used (cf. C. A. 4, 427) are described. A series of glass points is sealed into the manometer tube and the Hg meniscus set to a glass point. The compressibility of C_2H_2 is detd. for pressures from 105.43 mm. to 757.34 mm. The coeff. of deviation from Boyle's Law between 0 and 1 atm. = $(p_1v_1 - p_0v_0)/p_0v_0 = -0.00884$.

L. M. H. ?

A flow calorimeter for specific heats of gases. N. S. OSBORN, H. F. STIMSON AND T. S. ELIGH, JR. Bur. of Standards, *Sci. Papers* No. 503, 119-51 (1925).—This calorimeter was developed for measuring the sp. heat of gases accurately at pressures between 0.5 and 100 atms. and temps. below 150° . Many refinements were adopted which make the instrument responsive, reliable and accurate. An extensive series of measurements of sp. heat of superheated NH_3 vapor has been made at pressures between 0.5 and 20 atms. and temps. between -15 and 150° (cf. C. A. 18, 1). In a series of 108 expts. the results agreed over an entire range of temp. and pressure on an av. to within 0.1%. Complete details of construction, and arrangement of the instrument and accessory app. are given.

D. E. SHARP

A convenient friction flow meter for small rates of flow of gas. J. H. YOE. *J. Soc. Chem. Ind.* 44, 432T (1925).—The app. consists of a central removable disk, into the middle of which is cemented a glass capillary tube, 1 cm. or more in length. The disk is fastened to the app. by thumb nuts and the differential pressure is measured by the usual glass manometer.

T. S. CARSWELL

Design of column stills for distilling solutions of partly miscible liquids [furfural-governing the design or units for sepn. of miscible liquids given by Lewis (C. A. 16, 2561)] have been extended to cover the distn. of a soln. of 2 partly miscible liquids, such as furfural and water. In this case the distillate on cooling seps. into 2 liquid phases which may be sepd. by decantation to give a product contg. 95% of furfural, which is the technical furfural of commerce. The principles underlying the design of a continuous column still with continuous decanter (cf. La Forge and Mains, C. A. 17, 3184) are described. The method is also applicable to the distn. of mixts. of water with phenol, benzaldehyde, paraldehyde, amyl and butyl alcs. and aniline.

B. C. A.

A useful circuit for dielectric constant, power factor and conductivity measurements at high frequencies. P. A. COOPER. *J. Sci. Instruments* 2, 342-7 (1925). E. J. C.

Orsat gas tester, 1925 model. ANON. *Chem.-Ztg.* 49, 548-9 (1925); 1 cut.—The improvements are: a hand-operated generator replaces the battery for heating the combustion spiral; the spiral and connections are pure Pt; all parts are standardized, making replacements easy; the glass cock handles are replaced by stamped metal disks with

marks to show how cocks should be turned; the glass parts may be removed together from the case; the case is closed by a roll front drawn from a container below the glass parts, giving the app. greater stability. Operating directions, and a calcn. of the results of an analysis, are given. J. H. MOORE

A practical gas-collecting tube. ERICH MÜLLER AND F. FRIEDRICH. *Z. anorg. Chem.* 38, 724-5(1925); 1 cut.—The app. described in C. A. 14, 3339 is improved by attaching the leveling bottle to the tube just above the lower cock instead of to the cock. J. H. MOORE

Modern apparatus and plants for washing gas. G. WEISSENBERGER. *Chem. App.* 12, 122-4, 170-2(1925).—Brief descriptions, with 11 cuts. J. H. MOORE

Becker's rapid steam boiler without water space. BRÜSER. *Deut. Zuckerind.* 50, 57-63(1925).—Recent tendencies toward higher steam pressures call for differently boiler construction. • *Serpollat's boiler* used flattened thick-walled tubes with a water space inside only a few tenths of a mm. wide. This led to frequent failures by plugging. Becker's boiler uses tubes 26 mm. outside diam., 21 mm. inside diam., and sprays the water into the tubes. Twisted strips inside the tube give the mist a whirling motion. Regulators or engine governors, instead of throttling the steam, throttle the water supply. • A boiler of 64 sq. ft. heating surface weighs only 460 lbs. and evaps. 78.5 lbs. H_2O per hr. from feed at 8° to steam at 213 lbs. gage and 100° F. superheat with an overall thermal efficiency (boiler, furnace and superheater combined) of 76%. There is no danger of explosions—a leak or a burst tube is quite harmless as there is no reserve of superheated water in the boiler. Such boilers are especially suited for the very high pressures now coming into use. W. L. BADGER

Longitudinal joints in centrifugal baskets. BERTHOLD BLOCK. *Deut. Zuckerind.* 50, 769-76(1925).—A butt-strap riveted joint will have only $\frac{1}{8}$ the strength of the sheet because of bending moments in the butt-strap. Hammer-welded seams have 0.7 the strength of the sheet. Torch-welded joints are undesirable because of difficulty of inspection and danger of recrystn. Brazed joints are safe, as strong as the sheet (especially with Cu or bronze) but the best joint is formed by brazing the sheet and riveting a butt-strap on the outside of the joint. W. L. BADGER

Krupp steel V2A as a substitute for Pt in the chemical laboratory (ROTH) 9. Consistency of suspensions particularly of artists colors (v. DEURS, RAASCHOU) 2. A practical aid in the determination of calorific values (KELLER) 21.

BUCHNER, MAX: *Achema-Jahrbuch*, 1925. Leipzig-Berlin: Verlag Chemie, G. m. b. H. 182 pp.

Apparatus for separating dust and suspended impurities from gases. H. HÄGLER and Soc. DU CARBURATEUR ZÉNITH. Brit. 230,464, March 4, 1924.

Apparatus for separating air into its constituents. J. G. LOFFERTY. Can. 251,406, July 7, 1925.

Apparatus for controlling delivery of oxygen under high pressure. T. C. PROUTY. U. S. 1,551,908, Sept. 1.

Apparatus for drying materials by combustion gases. G. MÜLLER. U. S. 1,551,965, Sept. 1.

Electric discharge tubes. J. D. J. M. ABADIE and N. M. COURTINES. Brit. 230,467, March 4, 1924. The pressure of gas or vapor in a discharge tube is maintained const. by use of a substance which emits by vaporization or dissociation the same gas or vapor as that in the tube.

Thermionic valves. L. A. LEVY. Brit. 230,226, Jan. 22, 1924. Filaments of W, Mo, Pt-Ir, Pt electroplated with Cu or Ni or of W or Mo coated with Cd are provided with electron-emitting material operative at comparatively low temps. by use of an org. binder, e. g., cellulose acetate and acetone may be used with the product obtained by mixing thorium and Mg and heating to 1000° in H₂. Other examples are given.

Röntgen-ray tube. S. RUBEN. Brit. 230,183, Dec. 6, 1923.

2—GENERAL AND PHYSICAL CHEMISTRY

GEORGE L. CLARK AND BRIAN MEAD

Doctor Maclean and the doctrine of phlogiston. WM. FOSTER. *J. Chem. Education* 2, 743-7(1925); cf. *C. A.* 18, 3496. E. J. C.

The first epistle of Henry the chemist to the Uesaniens. H. E. ARMSTRONG. *J. Chem. Education* 2, 731-6(1925). E. J. C.

The discovery of benzene 100 years ago. O. SCHLENK. *Z. angew. Chem.* 38, 182-3(1925). E. J. C.

In memory of Dr. P. J. Montagne (1867-1925). W. P. JORISSEN. *Chem. Weekblad* 22, 453-4(1925); portrait; cf. *C. A.* 19, 632. E. J. C.

August Bernthsen on his 70th birthday. K. ELBS. *Z. Elektrochem.* 31, 389-90(1925); portrait. P. JULIUS. *Z. angew. Chem.* 38, 737-9(1925). W. VOIGTLAENDER-TETZNER. *Chem.-Zig.* 49, 729(1925). E. J. C.

Professor Heller. R. CORNUBERT. *Parfums de France* No. 30, 213-21(Aug. 1925). (In French and English).—Outline of his work, with portrait. A. P. C.

Some suggestions for modifying the content of high-school chemistry better to serve the purposes of a liberal education. R. W. OSBORNE. *J. Chem. Education* 2, 737-42(1925). E. J. C.

A comparison of grades in general chemistry earned by students who (A) have had, and (B) have not had high-school chemistry. W. A. EVERHART AND W. C. EBAUGH. *J. Chem. Education* 2, 770-4(1925). E. J. C.

A study of pupil errors in chemistry. J. C. BENNETT. *J. Chem. Education* 2, 760-9(1925). E. J. C.

Education, research and standardization. JOHN DEWRANCE. *J. Inst. Metals* 1925, preprint, 12 pp.—A lecture. E. J. C.

Organization of chemical research (in France). AUGUSTE BÉHAL. *Chimie et industrie* 14, 309-11(1925).—A plea for proper organization. A. PAPINEAU-COUTURE. E. J. C.

The importance of standard specifications and their interest to the chemist. J. M. LIMB. *Chem. Eng. & Mining Rev.* 17, 448-9(1925). E. J. C.

Coöperative research—a case report. C. D. LEAKE. *Science* 62, 251-6(1925). E. J. C.

Study of ions and electrons for electrical engineers. H. J. RYAN. *J. Am. Inst. Elec. Eng.* 44, 964-6(1925). C. G. F.

The historical development of stereochemistry. BERTHOLD RASSOW. *Naturwissenschaftler* 13, 606-7(1925).—The role of Joh. Wislicenus is emphasized. Reply. ERNST COHEN. *Ibid* 700. B. J. C. VAN DER HOEFEN

Liquefaction of helium in the Physikalisch-Technische Reichsanstalt. WALTHER MEISSNER. *Naturwissenschaften* 13, 695-6(1925).—Descriptive. B. J. C. VAN DER HOEFEN

Eka-manganeses. I. Chemical part. WALTER NODDACK AND IDA TACKÉ. *Naturwissenschaften* 13, 567-71(1925).—A preliminary report on the detection of two unknown elements, 43 and 75. On the basis of the periodic system the probable chem. and phys. properties of the 2 elements are qual. discussed; the relative occurrences in the earth's crust are estd. at 10^{-13} and 10^{-12} , resp. By various chem. methods efforts were made at concn. of these elements from Pt ores and from columbites and tantalites. II. X-ray part. OTTO BERG AND IDA TACKÉ. *Ibid* 571-4.—Definite evidence was obtained for the presence of both the elements in the final chem. concentrates. Columbite yielded a prepn. with 0.5% of No. 43 and 5% of No. 75 (initial concn. about 10^{-7} to 10^{-8}). Sperrylite, gadolinite and fergusonite also contain 43; in Pt ore, tantalite and wolframite 75 was found. The $K_{\alpha 1}$, $K_{\alpha 2}$, $K_{\beta 1}$ of the former and the $L_{\alpha 1}$, $L_{\alpha 2}$, $L_{\beta 1}$ and $L_{\beta 2}$ of the latter element were measured. Names proposed are *masurium*, Ma, for No. 43 and *rhenium*, Re, for No. 75. B. J. C. VAN DER HOEFEN

Revision of the weight of the normal liter and the deviation from the Avogadro law of methyl chloride gas. T. BATURCAS. *Anales soc. españ. fís. quim.* 23, 343-57(1925); cf. *C. A.* 19, 2763.—MeCl was obtained (1) from PCl_5 and MeOH and (2) by heating Me_2NCl . The d. was detd. first, and if this showed the gas to be pure it was used for compressibility detns. The av. of 17 detns. in 9 series gave the wt. of the normal liter as 2.3084, higher by $1/190$ than the Baume detn. Compressibility tests showed that the function pV and p is not linear but parabolic. Like the case of Me_2O , if the factor $(1 + \lambda)$ is calcd. by linear extrapolation at two different pressures the greatest departure from the Avogadro law, or $1 + \lambda = 1.0247$, is that corresponding to the pressure interval of about 1 atm. From this value and that obtained for the normal liter the mol. wt. of MeCl gas can be calcd. as 50.493, and the at. wt. of Cl as 35.470, the

latter perhaps a little high but in good agreement with recent detns. This proves that the Berthelot d. limit law applies rigorously to MeCl only for pressure intervals of about 1 atm. Cf. C. A. 19, 2894.

E. M. SYMMES

Revision of the atomic weight of aluminium. III. Analysis of aluminium chloride. H. KREPELKA AND N. NAKOLIC. *Chem. Listy* 19, 158-63 (1925); cf. C. A. 18, 3497. The AlCl_3 was prepd. by the reaction between dry $\text{Al}(\text{OH})_3$, C and Cl_2 . Pure Al used by Richards and Krepelka (*J. Am. Chem. Soc.* 42, 221 (1920); C. A. 15, 195) served as the starting material. It was dissolved in pure HCl , $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$ pptd. by passing gaseous HCl into the soln., and the salt purified by successive recrystn. until tests for Fe gave neg. results. The material was recrystd. once more, centrifuged and dissolved to a soln. of known concn. Pure sugar charcoal was added to the soln. in the ratio $2\text{AlCl}_3 : 3\text{C}$ and $\text{Al}(\text{OH})_3$ pptd. by pure NH_4OH to obtain an intimate mixt. of $\text{Al}(\text{OH})_3$ and C. The ppt. was washed thoroughly with hot H_2O , dried and ignited in an atm. of N_2 . Reaction of the mass of Al_2O_3 and C with Cl_2 took place in a special app., in which the resulting AlCl_3 was sublimed *in vacuo* several times to remove excess Cl_2 , and filled into bulbs for weighing. Five detns. of the ratio $\text{AlCl}_3 : 3\text{Ag}$ yielded an av. $\text{Al} = 26.974 \pm 0.001$ ($\text{Cl} = 35.457$) and $\text{Al} = 26.971 \pm 0.001$ ($\text{Cl} = 35.458$). Two detns. of the ratio $\text{AlCl}_3 : 3\text{AgCl}$ gave $\text{Al} = 26.972$ ($\text{Cl} = 35.457$) and $\text{Al} = 26.970$ ($\text{Cl} = 35.458$). $\text{Ag} = 107.880$ was used throughout.

F. C. KRACEK

Periodic classification of the elements from the point of view of the study of isotopes. S. SHCHUKAREV. *Neue Anschauungen in der Chemie* 9, 61-120 (1924).—All elements are derived from the disintegration of 4 parent elements, of which 2, namely Th and U, are known. The nuclei of elements consist of protons, electrons, α -particles and He atoms. The α -particle is given off as such; the He atom is given off in 3 stages, namely, an α -radiation and 2 successive β -radiations (the α, β, β -transformation which thus results in the formation of isotopes). The α - and α, β, β -transformations can be so arranged as to give all known and some unknown isotopes. There are, e. g., between niton and xenon 16 α - and 6 α, β, β -transformations, between Xe and Kr 9 α - and 3 α, β, β -transformations, between Kr and Ar 9 α - and 3 α, β, β -transformations, between Ar and Ne 4 α -transformations, and between Ne and Li 3 α - and 1 β -transformation. The existence of isobars is explained on the theory expressed. It is shown that the outer periodicity of the electron structure appears to be superimposed on the inner periodicity of the nuclear structure. The different changes are represented in tabular form.

B. C. A.

Why has the Mendelyev system periods of 2, 8, 18, 18, 32? A. LANDE. *Naturwissenschaften* 13, 604-6 (1925).—A review of some work of Bohr, Sommerfeld and L.

B. J. C. VAN DER HOEVEN

An approximate calculation of the atomic vibration numbers of the elements of the zero group of the periodic system of elements. J. NARBUTT. *Physik. Z.* 26, 470-2 (1925).—The ratio of at. vibrations in the solid and liquid states is not const. for elements in the 0 group. For Na, K, Rb, Cs this ratio is $\frac{4}{3}$, and can be estd. systematically from the linear relation $\sigma = 3R/2((a-1)/a)\theta + 3RT, \ln a$. Since the ratio a is σ/T , and since $\theta = \beta v$, its numerical value will afford an indirect means of calc. at. frequencies. In this way, sp. heat data throw light on at. vibrations of the inert gases (cf. Eucken, *Physik. Z.* 22, 32 (1921)). At. vibration nos. assume their highest values in the neighborhood of the f. p. for elements of the 0 group.

H. R. MOORE

Theory of positive and negative valences. IGNACIO PUIG. *Estudios teor. pract. del. Instituto quim. Sarria Barcelona* 1924, No. 16, 26 pp., Sep.; *Chem. Zentr.* 1924, II, 2629. —P.'s electronic theory of chem. reactions is a direct consequence of his new conception of the periodic system. In common with current views, both pos. and neg. valences are localized in the outer shell of planetary electrons. Neg. valences are due to the migration of electrons from intra-at. shells to the outermost level, which tends to take on its full complement of 8 electrons.

H. R. MOORE

Affinity, valence and electrons. H. J. PRINS. *Chem. Weekblad* 72, 302-11 (1925).—

*A review.

B. J. C. VAN DER HOEVEN

The molecule in a crystal. R. O. HERZOG AND K. WEISSENBERG. *Kolloid-Z.* 37, 23-4 (1925).—The phys. mol. is the smallest vibrating particle in gases or solns. The chemist's mol. is dependent on chem. compn. Often both lead to the same mol. wt. In crystals, the atoms are the phys. mol., while several chemists consider the whole crystal the mol. It would be better to drop the word mol. in speaking of crystals and use "dynades" or "dynadt" would indicate the units which repeat themselves in forming a crystal and which are detected by an X-ray diagram. These are usually multiples of small mols., but are fractions of such large mols. as those furnished by rubber, proteins and polysaccharides.

F. E. DROWN

The lattice theory of the crystals of titanium dioxide, rutile and anatase. O. F.

BOLLNOW. *Z. Physik* 33, 726-40(1925).—Mathematical treatment of a coordinated lattice with one parameter. The energy contents of the two lattices for TiO_2 are almost exactly the same. F. R. B.

The lattice theory of rutile. M. BORN AND O. F. BOLLNOW. *Naturwissenschaften* 13, 559(1925).—It follows from the work of Greenwood (*C. A.* 19, 425), that in TiO_2 all Ti-O distances are equal. This makes the lattice structure dependent upon only one parameter ϕ (e. g., the ratio of smallest distance Ti-O to diagonal of basal square). M. and B. consider this type of structure as a compromise between on one side octahedric arrangement of 6 O-atoms around one Ti, on the other side triangular coplanar arrangement of 3 Ti-atoms around one O. For both cases, assuming a min. electrostatic energy of the cohesive forces, a value of ϕ can be computed, 0.293 and 0.333, resp. It is shown that the natural ϕ for all crystals of this type TiO_2 , SnO_2 , and MgF_2 lies practically in the middle between these values. B. J. CAVAN DER HOVEN

An X-ray spectrograph for scattered radiation. P. A. ROSS. *Phys. Rev.* 23, 662(1924).—In this spectrograph a fixed crystal has a lead or gold wedge of 60° angle brought into contact with the crystal face. No slit is used so that the secondary radiator may be brought close up to the crystal. GEORGE L. CLARK

X-ray reflection from very thin crystals. O. L. SPONSLER. *Phys. Rev.* 23, 662(1924).—A study of X-ray diffraction by vegetable fibers in different directions proves the theory that many planes of atoms are necessary to produce sharp lines, while a small number of planes should produce blurred lines. GEORGE L. CLARK

A graphical method for the utilization of rotation spectra in crystal structure determinations. M. L. HUGGINS. *Phys. Rev.* 23, 663(1924). GEORGE L. CLARK

The crystalline modifications of $\text{NaAlSi}_3\text{O}_8$. N. L. BOWEN AND J. W. GREIG. *Am. J. Sci.* 10, 204-12(1925).—Two cryst. modifications of $\text{NaAlSi}_3\text{O}_8$ have been recognized, the hexagonal form, nephelite, stable below 1248° ; and an intricately twinned form, carnegieite (soda anorthite), stable above 1248° . The form which is stable above 1248° is found to be isometric, and assumes the intricately twinned, birefringent state as a result of a low-temp. inversion. Thermal effects were measured by the method of the differential thermocouple. The low-temp. inversion occurs at 690° corresponding to an abrupt appearance or disappearance of birefringence. In one of the prepn. investigated, still another inversion took place at 226.5° with an abrupt increase of birefringence on heating and a very gradual fading out of birefringence on cooling. The upper inversion occurred at 655° for this prepn. R. J. HAVIGHURST

Crystallography of methylphenylmethylchloramine. D. J. FISHER. *Am. J. Sci.* 10, 201-3(1925).—Crystals grown from ligroin and alc. solns. belong to the normal class of the monoclinic system, with $a:b:c = 0.402:1:0.365$, $\beta = 67^\circ 16'$. Cleavage $\parallel b(010)$. Approx. ns are $\alpha = 1.64$; $\beta = 1.68$; $\gamma = 1.74$. R. J. HAVIGHURST

Crystal structure of titanium and chromium. R. A. PATTERSON. *Phys. Rev.* 26, 56-9(1925).—Precision measurements of the crystal structure give for Cr (99.8% pure) a body-centered cubic structure with $a_0 = 2.872$ A. U. and for Ti (99.9% pure) a hexagonal close-packed structure with $a_0 = 2.951$ A. U., axial ratio $c/a = 1.590$. Computed densities for Cr and Ti, resp., are 7.23 and 4.49. D. C. BARDWELL

Crystallography of potassium fluozirconate. D. E. KERR-LAWSON. Univ. of Toronto, *Geol. Series* No. 20, 63-7(1925).—The crystals are monoclinic instead of rhombic as reported by Marignac. $p_0:q_0:r_0 = 1.0418:0.5971:1$, $e = 0.0058$, $\mu = 89^\circ 40'$. $a:b:c = 0.5731:1:0.5971$, $\beta = 89^\circ 40'$. L. W. RIGGS

An X-ray investigation of some alloys. ALFRED SACKLÓWSKI. *Ann. Physik* 77, 241-72(1925).—Alloys of Ag-Cu, Cu-Ni, Pb-Mg, and Sn-Mg were investigated by the powder crystal method with a Bohlin-Seemann spectrograph. The system Ag-Cu is miscible between 0-9.7 and 96.4-100 mol. % Cu, with the length of side of the unit cube obeying Vegard's law of additivity fairly well. The system Ni-Cu is completely miscible, with the length of side of the unit cube obeying Vegard's rule. There is no evidence for the existence of the compds. NiCu or Ag_3Cu_2 . The compds. PbMg_2 and Sn-Mg_2 give the diffraction pattern of a face-centered cubic lattice with $a_{\text{PbMg}_2} = 6.7$ A. U. and $a_{\text{SnMg}_2} = 6.75$ A. U. R. J. HAVIGHURST

Crystal structure of copper-manganese alloys. R. A. PATTERSON. *Phys. Rev.* 23, 552(1924).—On adding Mn to Cu a solid soln. results up to 30% with the unit face-centered cube of Cu increasing 3.60 to 3.70 A. U. on account of the replacement of Cu by Mn. At 50% Mn faint interference spots due to a new lattice formation are apparent. At 90% Mn the face-centered cube has increased to 3.74 A. U. The system is, then, not quite one of complete miscibility beyond 35%. A min. m. pt. was observed at 30 to 35% Mn. Above this concn. the new lattice seems to add stability to the struc- F. C. AUSTIN

- Elastic properties of metallic mixed crystals.** G. SACHS AND F. SAEPEL. *Naturwissenschaften* 13, 744(1925).—The change in deformability (contraction of a section after breaking) of a metal was found to be inversely proportional to the change in hardness as a result of measurements on alloys of Ag with Cd, Zn, Sb, Sn, Al, Hg and Mn. The ultimate tensile strength increased only in narrow limits. B. J. G. v. d. H.
- The crystal structure of manganese.** ARNE WESTGREN AND GÖSTA PIIRAGMEN. *Z. Physik* 33, 777-88(1925).—The elementary cube of Mn contains 56 atoms and has a length of 8.804 A. U., the calcd. d. being 7.21. The high temp. form of Mn is also cubic with a lattice const. of 6.289 (or twice that) an at. no. 20 (or 160) and a d. of 7.29. Electrolytic Mn has a face-centered tetragonal lattice with a base of 3.774 A. U. and a height of 3.533 A. U. Each lattice cell contains 4 atoms. It is not absolutely proved that this form of Mn is not a hydride but the d., 7.21, makes it unlikely. C dissolves in Mn in the form of a subsidiary lattice and not by displacing Mn atoms in the original lattice. F. R. B.
- The velocity of dissolving and the etching figures of crystals.** G. TAMMANN. *Z. anorg. allgem. Chem.* 146, 413-9(1925).—A treatise on the action of corrosive solns. of varying strength upon crystal surfaces. An explanation is given of the homogeneous and of the different kinds of selective aggression. JOHN T. STERN
- The orientation of etching figures and the arrangement of the atoms in the grating.** G. TAMMANN AND W. KRINGS. *Z. anorg. allgem. Chem.* 146, 420-32(1925).—Data are compiled on the etching of PbS, NaCl, KCl, CaF₂, ZnS, pyrite and CaCO₃ crystals and the relation to the grating is illustrated. The first furrows are found to arise along the lines of densest packing of the atoms. Some cases are mentioned which cannot be explained in this way. J. T. STERN
- An investigation of the alleged allotropy of zinc by X-ray analysis and a redetermination of the zinc lattice.** W. M. PEIRCE, E. A. ANDERSON AND P. VAN DYCK. *J. Franklin Inst.* 200, 349-61(1925).—X-ray examn. by the powder diffraction method of powdered very pure metal verifies the finding by Hull that Zn occurs with a hexagonal close-packed structure having an axial ratio 1.86. Further, there is no change within the limits of exptl. error in the diffraction pattern of Zn at atm. pressure between 20° and 400°, proving the absence of any allotropic transformation in this range. A new measurement of the axial ratio on the optical goniometer gives the above value for Zn crystals instead of the previous crystallographic value 1.356. G. L. CLARK
- The slip resistance of metal crystals.** O. HAASE AND E. SCHMID. *Z. Physik* 33, 413-28(1925).—The increase in slip resistance of metal crystals by very small stretching is prevented by a rise in the elastic limits. These appear to depend upon the lattice type in such a way that the necessary shoving tension during plastic deformation in the gliding planes and direction is a constant. For a crystal of Zn this shoving tension for the basal planes is 36 g./sq. mm. The increase in slip resistance during stretching mounts with the speed of stretching. The decrease in slip resistance for Sn and Bi crystals during small stretching was studied by means of the velocity of flow. Other expts. on slip relationships are described. GEORGE L. CLARK
- The structure of glass.** N. SELVAKOV, L. STRUTINSKII AND A. KRASNIKOV. *Z. Physik* 33, 53-62(1925).—A careful reinvestigation of the X-ray diffraction by glass proves that it is a supercooled amorphous liquid. Even if the crystals contained only 8 atoms there should be some evidence of maxima according to the Debye intensity theory. Hexagonal quartz gives the parameters $a = 4.86$, $c = 5.36$ A. U.; α -cristobalite (pseudocubic) gives $a_{000} = 6.94 \pm 0.03$ A. U.; β -cristobalite (cubic) gives $a_{000} = 7.1$ A. U. The strongest lines of tridymite are listed. By the Debye method, crystd. silicates with 53, 53 and 70% SiO₂, an excess in all cases over that necessary for Na-SiO₂, were analyzed. In no case was there evidence of any crystal modification of SiO₂ in disagreement with the work on glass of Lebedew and others, who showed that the curves which express the dependence of n and the coeff. of expansion on the temp. reach a sharp max. at 575° (the transition temp. of α to β cryst. quartz). This change must therefore be ascribed to mols. and to the existence of SiO₂ in silicates unchanged. GEORGE L. CLARK
- Some electrical properties of liquid sulfur.** D. H. BLACK. *Proc. Cambridge Phil. Soc.* 22, 393-9(1924).—The cond. of liquid S varies with the temp., in a manner similar to that in which the viscosity varies. The cond. reaches a max. at about 160° and then decreases rapidly to a min. at approx. 190°. Since the cond. varies with time, the observations on the variations of cond. with temp. were taken at fixed intervals of time. The conduction is believed to be electrolytic in character, the "ions" consisting of S_x and S_y. There is a definite e. m. f. of polarization. L. M. H.
- The microscopical examination of chemical products.** I. C. H. BUCHER. *Ind.*

Chemist 1, 324-7(1925).—B. shows how easily sublimed S, pptd. S and powd. roll S may be differentiated under the microscope. Slicks X 300 are shown. E. G. R. ARDAGH

Elastic after-effect and plasticity. RICHARD BECKER. *Z. Physik* 33, 185-214 (1925).—The Boltzmann theory can be derived upon the assumption of a plastic inhomogeneity of the material and a velocity of flow proportional to the force. Since metals do not obey these conditions, modifications of complex mathematical nature are made, with the assumption that the flow of metals occurs in single discrete steps controlled by probability laws. GEORGE L. CLARK

Determination of the melting point of carbon. H. ALTERTHUM, W. FEHSE AND M. PIRANI. *Z. Elektrochem.* 31, 313-6(1925).—By using a method previously (C. A. 17, 1565) described for the m. p. detn. of W and Mo, a pure graphite rod (0.1% ash), 140 mm long and 37 mm. diam., was provided with a narrow boring perpendicular to the axis, 3 mm. diam., heated slowly by an elec. current (8000 amps., 8 v. a. c. max. necessary) until the black body radiation, coming from the hole and measured pyrometrically, reached a max., just before the melting of the graphite started at that point, filling up the hole. The expt. took place in a H atm. of 800 mm. pressure; the potential applied was insufficient to start arc formation. The Δv of 10 detns. is $3740^\circ \pm 65^\circ$ abs. for the m. p. The subsequently fused sections are shown in photographs. B. J. C. VAN DER HOEVEN

Liquid hydrogen sulfide as a source of laboratory supply of the gas. C. J. MOORE. *Ind. Eng. Chem.* 17, 1023(1925).—Liquid H_2S can be procured in small quantities for 50 c. per lb. (0.45 kg.). A cylinder contg. 20 lbs. (9.07 kg.) at 38° has a pressure of 281 lbs. per sq. in. (723 kg. per sq. cm.) and at 65.5° 500 lbs. per sq. in. (1465 kg. per sq. cm.). A special gasometer with a seal fluid in which H_2S is insol. eliminates reducing valves. The advantages of liquid H_2S over the ordinary generators are apparent. W. H. B.

Specific gravity of solid binary compounds. U. PANICHI. *Atti Accad. Lincei* [v], 33, 572-9(1924).—With minerals (cf. C. A. 19, 2150) and a no. of solid binary compds. examd., as the ratio of the at. vol. to the valency of the element combined with the non-metal decreases, the excess of the calcd. d (loc. cit.) over the actual d. tends first to assume max. positive values and then to diminish gradually. B. C. A.

The melting point of hafnium oxide. F. HENNING. *Naturwissenschaften* 13, 661(1925).—Mps. were detd. in a W furnace (pyrometrically) of ZrO_2 ($2960^\circ \pm 20^\circ$ abs.) and of $2ZrO_2 \cdot HfO_2$ mixts. The extrapolated value for the m. p. of pure HfO_2 is $3085 \pm 25^\circ$ abs. B. J. C. VAN DER HOEVEN

The aging of ferrous hydroxide and ferrous carbonate. OSKAR BAUDISCH AND L. A. WELO. *J. Biol. Chem.* 64, 753-70(1925).— $Fe(OH)_2$ and ferrous bicarbonate pptd. in the absence of O_2 remain white and, apparently, unaltered, even in the presence of KNO_3 or of lactic acid or uracil. If air is admitted immediately after mixing, the KNO_3 is reduced or the lactic acid or uracil is oxidized. But, if air is not admitted until several hrs. have elapsed, the ppt. is oxidized to the ferric condition without any change in the KNO_3 , lactic acid or uracil. The Fe, though still ferrous, is no longer active. The mol. configurations that seem to be possible are discussed. I. GREENWALD

Magnetic form of ferrous oxide. J. B. FERGUSON. *J. Wash. Acad. Sci.* 15, 279-80(1925).—The results "seem to indicate that there is a form of FeO which is magnetic in character. Whether this form has a stability range from about 630° to the transition temp. at approx. 570° , or whether it occurs as an unstable phase, is a question that cannot now be answered." W. W. STIFLER

The two-stage transformation of magnetite into hematite. LARS A. WELO AND OSKAR BAUDISCH. *Phil. Mag.* 50, 399-408(1925).—On heating the magnetic oxide, Fe_3O_4 , in a stream of O_2 it oxidizes to Fe_2O_3 at about 220° with sufficient rapidity for the change to red to be observed. The low-temp. oxidation is accompanied by no change in crystal structure and the magnetic property is not only retained, but the max. permeability increases from 2.93 to 3.39. If this Fe_2O_3 is then heated in a neutral atm. (N_2) to 550° the max. permeability falls to 1.045 and the cryst. structure changes to that of ordinary Fe_2O_3 , showing that magnetic properties depend on the cryst. form and the change is a function of temp., not of the state of oxidation. If Fe_3O_4 be heated in the absence of O_2 it can be raised to 800° without permanent loss of permeability. S. C. LIND

Permutoid structure. H. KAUTSKY AND G. HERZBERG. *Z. anorg. allgem. Chem.* 147, 81-90(1925).—Such compds. as "siloxen," $Si_6O_3H_6$, behave as if the mol. structure was very loose, and are called permutoids. It is essential for this type of structure that the bodies which constitute it are neither sol. nor possess appreciable vapor pressure. In $Si_6O_3H_6$, H atoms are easily replaced with Cl, CH, NH_2 , etc. Photomicrographic study shows the structure to consist of extremely thin laminations, prob-

bly only 1-2 mol. thick, packed closely together like sheets of paper. These packs are grouped in layers, the individual packs themselves being quite thin, sometimes only μ thick. In the case of siloxen, which is formed by the action of HCl on calcium silicide, such structure must have been produced by the action of the acid on the silicide crystals in only one direction. The great reactivity of these compounds is undoubtedly due to the enormous surface presented to reagents, and the resultant high degree of absorption which this surface permits. In the production of permutoid structure the chem. action of the reagent continues sufficiently long, the laminations become finer and finer, until finally a colloidal soln. is obtained. Graphitic acid and biotite silicic acid are examples of permutoids. Photomicrographs are shown. H. S.

The thermal expansion of fused salts. RICHARD LORENZ AND W. HERZ. *Z. anorg. allgem. Chem.* **147**, 135-41 (1925).—Brunner expressed the relation between d and temp. with the formula $d = d_1 - b(t-900)$, while Lorenz used $d = d_0 - at$, the coeffs. a and b being identical. Jaeger used the quadratic form $d = d_1 - a(t_1 - t_2) + b(t_1 - t_2)^2$. In order to give expression to deviations from the linear, although these are small. In order to obtain the coeff. of expansion of fused salts, the best results are obtained by bringing the interpolation formula given in the literature into the form $d = d_1 - at$. If the coeff. of expansion α is defined with the equation $v = v_1(1 + \alpha t)$, there is obtained by substitution $d_t = d_1 - at + \alpha d_1 t - \alpha a t^2$. Neglecting the quadratic member because of the smallness of a and α , one obtains $\alpha = a/d_1$. A table is given in which α is calcd. for various salts, and the values so obtained are used to test van der Waals' assumption that $\alpha T_c = \text{const.}$, in which T_c is the critical temp. In one column of the table the product αT_c is given, in which T_c is the temp. of the fused salt in degrees abs., and this product is approx. const. From the work of various investigators it should be 0.230, which is near the av. value obtained. This product is influenced by the direction coeff. γ , which becomes greater with rising crit. temp., making αT_c greater. Values are given for many salts. H. STOERTZ

Study of uranyl oxalate. A. COLANI. *Bull. soc. chim.* **37**, 856-61 (1925); cf. C. A. **11**, 111.—(1) *Action of heat.* C. confirms M. Courtois' (C. A. **8**, 3009) results in obtaining $\text{UO}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ from the trihydrate by heating to const. wt. at 100° . Rehydration results upon exposure to air. (2) *Sol. in water.* (g. of anhyd. salt per 100 g. water) 14° , 0.45, 20° , 0.50; 50° , 1.00, 75° , 1.65, 100° , 3.06. (3) *Sol. in acids.* Uranyl oxalate is fairly stable in dil. but readily decomp. in strong acid solns. Tables are given for HCl, H_2SO_4 , HNO_3 , H_3PO_4 and $\text{H}_2\text{C}_2\text{O}_4$. (4) *Action of salts.* Double salts with the alkalis are obtained by boiling with concd. solns. and crystg. P. B. P.

Experiments on the further growth of metallic crystals by separation from the gas phase. II. H. FISCHVOIGT AND F. KOREF. *Z. tech. Physik* **6**, 296-81 (1925); 2 cuts; cf. C. A. **17**, 1356. The relations for the further growth free from disturbance of individual W crystals has been studied. The W crystals were obtained from a H_2 -WCl₆ atm. in which the H_2 was much in excess. By this procedure the velocity of increase of size of the crystals was reduced. J. H. PERRY

Correction and addition to my paper on electrical conductivity in crystals. F. v. RAUTENFELD. *Ann. Physik* **75**, 848-50 (1924); cf. C. A. **18**, 1230.—R. corrects his previous results. Further detls. for rock salt show the same cond. for plates along the cube, rhombododecahedron or octahedron (cf. C. A. **19**, 591). Below 650° , the values deviate from the single exponential law of conductors toward the reciprocal exponential law of insulators. G. CALINGAERT

The diffusion of helium through several widely different glasses. C. G. VAN VOORHIS. *Phys. Rev.* **23**, 557 (1925).—The rate of passage of He from a pressure of 1 atm. into a vacuum through a wall of 1 mm. thickness was, resp., for Pyrex at 200, 300, 400 and 500° , 0.188, 0.664, 1.90 and 4.274 cu. mm. (N. T. P.) per sq. cm. per hr. For 702-P glass the permeabilities were 0.55, 0.60, 0.62 and 0.68 that of Pyrex, resp. In soft glass the rate is only a few hundredths that of Pyrex. Bases lower the permeability in the order of their basicity. SiO_2 and B_2O_3 increase the permeability while PbO and Al_2O_3 have little effect. F. O. ANDEREGG

Diffusibility of helium through crystalline septa. A. PIUTTI AND E. BOGGIO-LERA. *Atti accad. Lincei* [v] **33**, 532-7 (1924); cf. C. A. **18**, 1594, 2273.—At 480° , He cannot traverse thin sheets of mica or thin sections of quartz cut either parallel or perpendicular to the optic axis, although it is able to pass through both ordinary and silica glasses. According to recent views, such glasses are considered to be composed of liquids of high viscosity. B. C. A.

A critical discussion dealing with carbon monoxide, carbon dioxide and hydrogen. Application to blast furnaces and to gas producers. J. THIEBAU. *Rev. universelle mines* [7] **6**, 313-48 (1925); **7**, 25-42, 74-92, 156-68, 186-99 (1925).—A discussion of the

phys. chemistry of CO, CO₂ and H in relation to their reactions in the blast furnace and in gas producers. The subjects considered include the general principles of chemistry involved, such as reversible reactions, the quant. laws of equil. between C, CO and CO₂, the free energy of chem. reactions and the combustion of C with O to form CO and CO₂ and in their applications to the blast furnace the combustion of C at the tuyères, the temp. at the tuyères, the theory of the reduction of Fe oxides, the compn. of the gas and the operation of the furnace, calcns. of the ideal and practical operation and the regulation of the latter and possible improvements in the blast furnace. The article is replete with diagrams and graphs and with extensive calcns. and quant. data.

C. C. DAVIS.

Preparation and analysis of constant mixtures of air and carbon dioxide. JOHN JOHNSTON AND A. C. WALKER. *J. Am. Chem. Soc.* 47, 1807-17 (1925).—Concn. of the CO₂ in air at New Haven over a period of 15 months in 1921-22 showed a variation from 294 to 407 p. p. m. The av. was about 345 p. p. m. The variations appeared to be entirely fortuitous and were sometimes rapid. Mixts. of CO₂ in air of const. compn. were obtained with an app. in which a stream of air at const. pressure passed over one side of a thin rubber diaphragm and a stream of CO₂ also at const. pressure passed over the other. The CO₂ diffuses through the rubber more rapidly than the air. The compn. obtained with an identical diaphragm will change with time, but will be const. within 10 p. p. m. for several days. CO₂ was detd. in mixts. of air by absorption in Ba(OH)₂ soln., collecting the ppt. under conditions which exclude air and titrating the excess Ba(OH)₂. Details of the app. are given.

A. W. KENNEY

The isotherms of various gases between 400° and -183°. L. HOLBORN AND J. ORTO. *Z. Physik* 33, 1-12 (1925).—The isotherms of H₂ were measured at -50, -100, -150 and -183° at pressures of 20-100 atms. The isotherms of Ne were measured over the same pressure range at 400, 300, 200, 100, 0, -50, -100, -150 and -183°. From these isotherms together with other data from the Reichsanstalt tables are constructed for the PV values of He, H₂, Ne, N₂, A, O₂ and air over the whole temp. range 400° to -183° as well as tables of the coeffs. of the Kammerling Onnes equation of state and of the correction to the gas thermometer.

Y. R. B.

The chemical theory of corresponding states. GEORGES BOITARD. *J. chim. phys.* 22, 349-52 (1925).—A mathematical discussion of the theory. E. R. SCHIERZ

Potassium as a mercury-vapor trap. A. L. HUGHES AND F. E. POINDEXTER. *Phil. Mag.* 50, 423-39 (1925).—H. and P. have investigated the use of K to prevent the passage of Hg vapor from a Hg vapor pump. The K is distd. and condensed so as to form a deposit in the tube designed to act as a trap. The vacuum was tested by means of an ionization gage. K was found as effective as liquid air. The residual pressure, of the order 1×10^{-7} to 5×10^{-9} mm., is regarded as due to incomplete outgassing rather than to Hg vapor.

S. C. LIND

The separation of the rare gases by direct current discharge. Interferometric determination of rare gas mixtures. F. SKAUPY AND F. BOBEK. *Z. tech. Physik* 6, 284-7 (1925).—The Löwe gas interferometer, its calibration and use in rare gas analysis are described. The sepn. of rare gases in the d. c. is the more complete, the greater the current strength used and the smaller the pressure, within certain limits which are fixed for a given exptl. arrangement. Data for Ar-Ne mixts. are included.

J. H. KERRY

The vapor pressure of some glass components at room temperature. FRITZ BORN. *Z. Elektrochem.* 31, 312 (1925).—From Nernst's and Trouton's equations, it is estd. that the highest (O) pressure reached by metal oxides used in glassware at room temp. is from 10^{-16} to 10^{-20} mm.

B. J. C. VAN DER HOEVEN

Vapor pressures of mercury up to 2000 kilograms per square centimeter. FRITZ BERNHARDT. *Physik. Z.* 26, 265-75 (1925).—Three different app. were used in measuring the vapor pressure of Hg over the range 400-1435°, the pressures in all cases being read on a dial gage. The first, in which the Hg was heated in a glass capillary until boiling could be observed visually, was limited to pressures below 10 kg./cm.² by the strength of the glass. Corrections had to be made for entrapped air and for the temp., since the Hg was heated only locally, and there were considerable temp. gradients in all these expts. In the second app., the Hg was enclosed in a U-tube which was immersed in a pressure container filled with H₂O, so that the Hg and its container were subjected to hydrostatic pressure. Local heating was produced by means of a Pt spiral wound on the tube, and quartz windows in the pressure bomb enabled the b. p. to be detd. visually. There were no pressure corrections in this series, which ran up to 170 kg./cm.²; but the temp. had to be estd. as before. For higher pressures, a quartz U-tube was used in which the horizontal part consisted of a small capillary tube.

The entire U-tube was immersed in a pressure bomb as before, but this time the elec. heating current was passed directly through the Hg in the capillary. When vapor formed in this capillary, the elec. resistance was abruptly increased and there was a characteristic noise. The b. p. was, therefore, detd. by the discontinuity of the voltage-current curves. Figures read from the smooth curve are: 400°, 2 atm.; 600°, 22 atm.; 800°, 86 atm.; 1000°, 260 atm.; 1100°, 425 atm.; 1200°, 665 atm.; 1300°, 1025 atm.; 1400°, 1600 atm.; 1435°, 2020 atm. These data differ appreciably from Cailletet's, whose curve is somewhat steeper and crosses B.'s at 650°, 34 atm. The crit. temp. has been estd. as 1650°. The corresponding crit. pressure would be 3000–3500 atm.

A. W. KENNEY

Variation with pressure of the boiling points of naphthalene, benzophenone and anthracene. J. L. FINCK AND R. M. WILHELM. *J. Am. Chem. Soc.* **47**, 1577–82 (1925).—Since the b. ps. of the substances named are frequently used as fixed points on the thermometric scale, it is important to know the change of b. ps. with pressure for the range 700–800 mm. If the b. p. is represented by the equation $t_p = t_{760} + A(t_p + 273.1) \log(p/760)$, the following consts. apply: for naphthalene, $t_{760} = 217.95^\circ$, $A = 0.2075$; for benzophenone, $t_{760} = 305.84^\circ$, $A = 0.194$. For anthracene, $A = 0.201$; but its normal b. p. has not been detd. with sufficient accuracy to establish it as a fixed point in precise thermometry. Two samples gave t_{760} at 340.36 and 338.87.

A. W. KENNEY

A simple method of testing Gibbs' law. A. FRUMKIN. *Z. physik. Chem.* **116**, 498–500 (1925).—When lauric acid dissolved in petroleum ether is dropped on a water surface, the petroleum ether evaps., and the point of satn. of the surface with lauric acid may be easily observed by watching the behavior of each drop. One sq. cm. of water surface was satd. at 19° by 5.2×10^{-10} mol. of lauric acid. The formula of Gibbs, using measured values of the surface tension of lauric acid solus. (cf. *C. A.* **19**, 3046), gives a value of 5.7×10^{-10} mol. of lauric acid for the amt. necessary to sat. 1 sq. cm. surface.

R. J. HAVIGHURST

Relation between the critical temperature and the expansion of liquids. NICOLAS DE KOLOSOVSKII. *J. phys. radium* **6**, 99–104 (1925).—Numerous formulas have been proposed relating the crit. temps. of liquids with the coeffs. which characterize their expansion, such as k , defined by the relationship $V_t = V_{273}/(1 - kt)$, and α , defined by the equation $V_t = V_{273}(1 + \alpha t)$. Of these formulas, some are mutually exclusive and none has been generally applicable. Mendelyév's formula, $k(2T_k - 273) = 1$, in which T_k is the crit. temp., was found to be approx. correct for a variety of substances if k is recognized as a temp. function and is taken at the same reduced temp. for all cases. Thirty-six substances with crit. temps. varying from 127° to 1072° abs. gave values of the product $k_m = 0.6(2T_k - 273)$ varying in the extreme cases from 0.74 to 1.37, most cases being within 10% of unity, where $m = 0.6$ indicates the reduced temp. From van der Waals' considerations, it follows that $\alpha_m T = C$, the subscript indicating that α is calcd. at the same reduced temp. for all substances; and for the substances studied, this relationship was found to hold fairly well, with $C = 0.75$ at a reduced temp. 0.6. The generalized expression, therefore, becomes $k_m \{ (1 + mC)T_k/C \} - 273 = 1$. This is logically deduced from van der Waals' principle of corresponding states and on the basis of the figures already mentioned may be expected to hold approx. for all substances.

A. W. KENNEY

The surface tensions of aqueous solutions of various organic compounds. P. R. EDWARDS. *J. Chem. Soc.* **127**, 744–7 (1925).—Surface tensions were detd. by Ferguson's method (cf. *C. A.* **16**, 2436) for a variety of org. compds. The detns. were made at temps. 15 – 17° at low concns. Menthol, camphor and thymol, whose crystals "dance" on water, were shown to lower the surface tension. The following results at approx. 16° , where c = concn. in g. per 100 cc. of soln. and γ = surface tension in dynes per cm., are typical: menthol, $c = 0.0005$, $\gamma = 74.76$; camphor, $c = 0.0135$, $\gamma = 74.59$; thymol, $c = 0.0034$, $\gamma = 73.61$; phenacetin, $c = 0.1080$, $\gamma = 72.81$; *p*-toluidine, $c = 0.1000$, $\gamma = 69.67$; aceto-*p*-toluidine, $c = 0.1000$, $\gamma = 72.48$; piperonal, $c = 0.1600$, $\gamma = 72.83$; Me salicylate, $c = 0.3600$, $\gamma = 67.18$; Et malonate, $c = 1.9636$, $\gamma = 49.53$.

A. W. KENNEY

Cohesion forces of liquids. A. TH. VAN URK. *Verslag Akad. Wetenschappen Amsterdam* **34**, 351–9 (1925).—Assuming, according to Langmuir, that the mol. attractive forces in liquids act in definite directions and that the sphere of action is of the order of the mol. dimensions, U. constructs a model of a liquid at zero abs., consisting of mols connected by stiff rods. From it he derives that the mean surface-tension per mol σ_0 . $L_0/4$ (L_0 is the mean internal heat of vaporization per mol., both at 0° abs.) The mols are supposed to be cubically packed. Values extrapolated to 0° from data on

Baly, Donnan and of Kamerlingh Onnes show that for N_2 and A σ_0/L_0 is 0.25; for O_2 it is 0.267; for H_2 0.40. It is further noted that σ_0 both for N_2 and for A is exactly the double of kT_A , the kinetic energy per degree of freedom at the crit. temp.

Vaporization of small water drops. N. GOODRIS AND L. KULIKOVA. *J. Russ. Phys. Chem. Soc., Physical Part*, **56**, 167 (1924).—The rate of evapn. of water drops in an atm. of water vapor has been detd. Drops were examd. by using the Millikan charged-drop method. Evapn. at first takes place rapidly, but the rate falls off asymptotically. This is ascribed to presence of a gas film around the drops, the hypothesis being confirmed by using different gases. The influence of difference in vapor pressure of water in drop and in surrounding atm. was also detd.

Undercooling of water in capillaries. T. BOROVIK-ROMANOVA. *J. Russ. Phys. Chem. Soc., Physical Part*, **56**, 14-22 (1924).—The literature is first reviewed. U-shaped tubes were used and the temp. before solidification was detected by a thermoelement connected to a galvanometer. B. concludes that for the same capillary the temp. of under cooling is const. and depends upon the diam. of the tube. The lowest temp. obtained was -18.5° .

The consistency of suspensions, particularly of artists' colors. J. A. v. DEURS AND P. E. RAASCHOU. *Z. angew. Chem.* **38**, 382-7 (1925).—Consistency is taken as synonymous with fluidity. Using suction instead of pressure to obtain the shear the authors devise a new variable pressure viscometer and plastometer, called the *vacuum-viscometer*. They suggest the use of such an instrument in oil-testing since it gives abs. units and speed and accuracy are gained. The fluidity of a suspension is decreased in a linear manner as the concn. increases, until cubical close-packing results. They confirm the observation of Bingham, Bruce and Wolbach (*C. A.* **17**, 160) that the fluidity curves extrapolated to the fluidity of the vehicle does not give the fluidity of the pure vehicle. By filtering oil out from a paint they proved that there is an actual change in the fluidity of the oil due to the action of the pigment, which is not chem. in nature, being the same for several pigments. They state that after standing some time it is difficult to make the suspensions again homogeneous. Linear fluidity-weight-concn. curves are given for $BaSO_4$, Ti oxide, Fe_2O_3 , $CaCO_3$, ZnO and Al powder, the zero fluidities being reached at the following % concns., 70, 63, 60, 54, 47 and 35, resp.

Beryllium compounds as media for adsorption. JULIUS KLEBERG. *Kolloid-Z.* **37**, 17-8 (1925).— $Be(OH)_2$, $BeCO_3$ and Be borate were used to adsorb acid eosin, or basic methylene blue or acid Congo red. The dyes in water 1:1000 were shaken for 2 min. with equal masses of adsorbent and filtered. The largest no. of cc. of soln. which were completely decolorized were recorded as adsorption of the Be compd. CH_3CO_2H , sugar, tributyrin, amylase, paucease and invertin were also used. $Be(OH)_2$ is the effective adsorbent. Eosin, invertin, Congo red and amylase were adsorbed; methylene blue, CH_3CO_2H , sugar and tributyrin were adsorbed very little or not at all. Filter paper impregnated with the sol and dried was a better adsorbent than untreated filter paper. Gels more than 14 days old were ineffective. $Ba(OH)_2$ is a useful adsorbent with a basicity between that of $Al(OH)_3$ and $Fe(OH)_3$. It is most effective when fresh.

Adsorption and Schulze's law. H. B. WEISER. *J. Phys. Chem.* **29**, 955-65 (1925).—Schulze's law, that the pptg. power of an electrolyte is greater the higher the valence of the pptg. ion, is but little more than a qual. rule. In so far as the rule holds, the adsorbability of an ion is greater the higher the valence. The conclusion of Dhar and his collaborators that ions with the lowest pptg. power are adsorbed the most and *vice versa*, is both theoretically and experimentally unsound. An indirect method has been devised for detg. the relative adsorbability of weakly adsorbed univalent ions. With strong electrolytes contg. weakly adsorbed pptg. ions and the same stabilizing ion there is a direct relation between the relative adsorbability of the pptg. ions and the coagulating power of the electrolytes in the sense that the electrolyte contg. the most readily adsorbed pptg. ion coagulates a sol in lowest concn.

An investigation into the derivation of the adsorption isotherm. ALEXANDER GORZACHEV. *Z. physik. Chem.* **117**, 129-42 (1925).—Assuming that the amt. of adsorption depends on the density of the lines of force in the neighborhood of the surface, Langmuir's and Reichinstein's equations follow on the assumption that the no. of lines leaving the surface are const.; Smitz's and William's equations follow on the assumption that the no. are inversely proportional to the concn. of the unadsorbed substance; Freundlich's and Kroecker's equations follow on the assumption that the no. of lines of force leaving the surface are inversely proportional to the amt. of substance adsorbed.

kg./cm²;

the was

F. R. B.

The adsorption-pressure theory. R. F. LIESEGANG. *Kolloid-Z.* Special No., (Apr. 1, 1925), 82-3.—Traube (cf. *C. A.* 19, 2435) concludes from the work of Tomita (cf. *C. A.* 19, 2435) that the adsorption-pressure theory must be limited to lipid-containing gels. Tomita's work does not show that the theory is applicable even to these gels.

Adsorption of silver salts by silver iodide. J. S. BEEKLEY and H. S. TAYLOR. *J. Phys. Chem.* 29, 942-54 (1925).—Silver salts are adsorbed by AgI in the following order: benzoate > acetate > nitrite > bromate > naphthalene sulfonate > nitrate > chlorate > ethylsulfate > perchlorate. This order is not exactly the reverse of the order of solubilities of the salts but the less sol. are strongly, and the more sol. weakly, adsorbed.

H. M. McLAUGHIN
HARRY B. WEISER

Sorption of iodine and catalytic decomposition of hydrogen peroxide. Sorption by morite charcoals. Comparison of the sorption and catalytic activities. J. B. FIRTH and P. S. WATSON. *J. Phys. Chem.* 29, 987-94 (1925).—A study of adsorption by morite charcoals prepd. in different ways shows that the adsorption capacity is not materially increased by previous heating *in vacuo* at temps. higher than 100°. The catalytic decompn. of H_2O_2 is substantially increased by previous heating *in vacuo* at temps. 600° to 900°. The catalytic activity of a charcoal is not correlative with its adsorptive capacity for I from $CHCl_3$ soln.

HARRY B. WEISER

Molecular kinetic theory of adsorption. B. ILIIN. *J. Russ. Phys.-Chem. Soc.* Physical Part, 56, 2-13 (1924).—I. A mathematical paper. The change in concn. dC of the absorbed substance is expressed by $dC = \varphi(N)dt - \psi(C)dt$, where N is the number of free bonds of the sorbent, and $\psi(C)dt$ an increasing function representing the flow from the sorbent. Also $N + nC = \text{const.}$ When $N = 0$, adsorption stops, and at first approximation $\varphi(N) = \alpha(a - C)$, α and a being const. Since the flow away from the sorbent due to thermal motion is proportional to the concn. $\psi(C) = \beta C$. Then $dC = \alpha(a - C)dt - \beta Cdt$, whose integral is $C = \{a\alpha/(\alpha + \beta)\}[1 - e^{-(\alpha + \beta)t}]$. When $t \rightarrow \infty$ one gets $C_\infty = a\alpha/(\alpha + \beta)$, which is the sorptive capacity; then $C = C_\infty(1 - e^{-Kt})$, an expression that agrees well with many exptl. results, since sorption may be considered to consist of superimposed processes each of which is according to this equation. II. The relationship of C_∞ with abs. temp. is developed from $dC_\infty = dA - bC_\infty dv$, where dA is the change in C_∞ due to the change in bonds with temp. and $-bC_\infty dv$ depends upon the change in the velocity of the mol. Since dA may be considered to be zero, one gets on integration $C_\infty = C_0 e^{-\delta\sqrt{T}}$, or $\ln C_\infty = \ln C_0 - \delta\sqrt{T} \ln e$, where C_0 and δ are const. This equation applies well to the exptl. results of A. Titov (*C. A.* 5, 411), J. F. Homfray (*C. A.* 4, 2896), Giesen (*Drud. Ann.* 10, 838 (1903)) and Rakowski (*Z. Chem. Ind. Kolloid*, 11, 19 (1912)), and in the fields of biology and physiology the work of Hauberrisser and Schönfeld (*C. A.* 7, 2583). III. The velocity of sorption processes is given by $dc/dt = K C_\infty e^{-Kt}$, and when $t = 0$, the instantaneous velocity $W_H = (dc/dt)_{t=0} = K C_\infty$, W_H depending upon C_∞ , which decreases with temp. and also upon K which may increase with temp. The change of W_H with temp. is given as $dW_H = \epsilon W_H dv - \delta W_H d\sqrt{T}$, in integrated form as $W_H = W_0 e^{(\epsilon - \delta)\sqrt{T}}$, where W_0 , ϵ and δ are const. When temp. coeff. of K is greater than that of C_∞ , $\eta = \epsilon - \delta$ is pos. and W_H increases with temp. $\ln W_H = \ln W_0 + \eta\sqrt{T} \ln e$. IV. For coagulation of colloids as a simple case of adsorption I. assumes at equil. $f(x\epsilon)/\gamma_m n dx - dP = 0$, and develops the expression $C_\infty = S n_0 RT \gamma_0^m / f(x\epsilon) [e^{f(x\epsilon)/RT \gamma_0^m (\gamma_0 - \sigma)} - 1]$, where S is the surface of the absorbent, σ the sum of the radii of the adsorbing and adsorbed mols., γ_0 the thickness of the adsorbed layer, n the no. of mols. in unit. vol. and $f(x\epsilon)$ the mol. attraction of the adsorbent, being a function of the charge ϵ and valence x ; dP is the difference in the osmotic pressures in the direction away from the adsorbent. If the coagulation of colloids is due to adsorption of ions and colloidal particles, the above equation explains why the min. concns. of ions of different valencies having an equal coagulating action do not change correspondingly with their valence but are much stronger.

J. L. SHERKSHESKY

The mechanism of the adsorption of sugars by colloidal solutions and precipitates. MATA PRASAD, DASHARATH LAL SHRIVASTAVA and RAGHUNATH SAHAI GUPTA. *Kolloid-Z.* 37, 101-4 (1925).—This research was carried out to det. whether or not the adsorption of sugar followed the equation $x/ry = \beta c^{(1/n)}$, where x is the no. of g. of sugar adsorbed on m g. of sol or ppt., c is the no. of g. of sugar left in soln. at equil., and β and n are const. Xylose, mannose, arabinose, maltose, levulose and sucrose were adsorbed on As_2S_3 , Sb_2S_3 and CdS sols. It was assumed that adsorbed sugar loses its rotary power (cf. *C. A.* 18, 2828) and the amt. of adsorption was calcd. from the loss of rotary power. x/m always decreases with decreasing concn. of sugar. If the equa-

tion is correct, a straight line should result when $\log x/m$ is plotted against $\log c$. In some cases the line is straight and in other cases not.

The science of adsorption. II. S. LIPATOV. *Kolloid-Z.* **37**, 112-6 (1925); cf. *C. A.* **19**, 2152.—Increased amts. of adsorption of alkalis by cellulose have been noticed when alc. is added to their aq. solns. This research reports work on NaOH and Ba(OH)₂ in 40% alc. and 90% alc. Ba(OH)₂ is adsorbed much more than NaOH. NaOH is adsorbed from 40% alc. according to the equation $K = (1/\ln a)/(a - \gamma x)$, which is the equation for a monomol. reaction except that x is multiplied by the const. γ . In higher concns. of alc. the rate of adsorption approaches that in a H₂O soln. As the concn. of alc. increases the amt. of NaOH or of Ba(OH)₂ adsorbed increases very much. Adsorption from alc. is a chem. process. The values of the consts. β and γ/n in the formula $C_2 = \beta C_1^n$ depend on the valence of the reacting ion. On account of the decrease of the hydrolysis, adsorption from an alc. soln. is an irreversible process.

F. E. BROWN

The adsorption of water from the gas phase on plane surfaces of glass and platinum. I. R. MCHAFFIE AND SAM LENHER. *J. Chem. Soc.* **127**, 1559-72 (1925).—The adsorption of H₂O by plane glass and Pt surfaces was measured at temps. between 20° and 55°. A carefully evacuated glass or Pt bulb of known const. vol. and internal area was filled with H₂O vapor at an elevated temp. and the pressure measured at successively lower temps. The vol. of water vapor admitted was adjusted so that for a considerable range of lowering temps. the observed pressures were a linear function of the abs. temp. Over this range the mean value of the rate of increase of pressure per degree was found to be 0.0037, indicating that at the concns. employed the H₂O could be considered as a perfect gas. The mass of water present in the system was then calcd. from the $p-T$ curve by means of the equation $pV = nRT$. At some temp. depending on the mass of H₂O introduced the exptl. $p-T$ curve begins to fall below the linear extension of the curve at higher temps. because of the adsorption of some of the H₂O mols. on the solid surface. The amt. of adsorption at each temp. was detd. by calcg. from observed $p-T$ points by means of the equation $p_1V = n_1RT_1$, the mass of H₂O in the gas phase. Measurements were continued at successively lower temps. until the observed pressure corresponded to the vapor pressure of H₂O at the temp. in question. Reproducible results were obtained when any of the conditions were approached from either side. From the data obtained the no. of mols. of H₂O adsorbed per sq. cm. at each pressure and temp. was calcd. with a probable accuracy of 0.5%. This value varied over the range studied, from 0 to 2188 for glass and from 0 to 463.5 for Pt, corresponding to films 0.0 to 5.3×10^{-6} and 0.0 to 1.13×10^{-6} cm. thick, resp. The higher values correspond to adsorbed films, the equl. pressures of which are equal to the vapor pressure of water. The decrease of free energy corresponding to each adsorbed film was calcd. In the temp.-pressure range covered this varied from 0 to 468 cal./degree for glass, and from 0 to 146 cal./degree for Pt.

R. L. DODGE

Electric theory of adsorption. BORIS ILIIN. *Z. Physik* **33**, 435-69 (1925).—Proceeding from the assumption of the elec. nature of adsorption forces and the circumstance that the energy of the adsorption field U is related to the intensity E by the classical

formula $U = S \int_0^2 (\epsilon E^2/8\pi) dx$ (S = surface of adsorbent, E = dielec. const.) it follows

that the adsorption const. (heat of adsorption Q and capacity A) are related to ϵ and the surface energy U_1 of the adsorbent by $Q = (E_0^2/8\pi)[(\epsilon_0 - 1)/\tau N_0]$ and $U_1/S = (QN_0\epsilon/\epsilon_0 - 1)r_0'$, where E_0 is the intensity in vacuum, ϵ_0 the dielec. const. at 0° and 760 mm., τ the polarization moment of the adsorbed mols., N_0 the no. of gas mols. in 1 cc. at 0° and 760 mm., r_0' = thickness of adsorbed layer. Calcns. of τ and r_0' for several gases adsorbed on charcoal and mica give an order of magnitude of 3 to 20×10^{-18} and 10^{-8} , resp. The adsorption capacity A at low temp. is expressed by $A = S\gamma_0 n_0 eQ/RT$, and at high temps. by $A = S\gamma_0 n_0 (RT/Q + RT)e(Q + RT/RT)$. R calcd. from these has a value of 2 cal., thus proving the validity of the derivations. A parallelism exists in the course of the adsorption const., the attraction const. of van der Waals and the crit. temp. of the adsorbed gas. The adsorbing surface of lg. charcoal is calcd. to be theoretically 10^8 sq. cm. With equal heats of adsorption the amts. of adsorbed gases on different adsorbents (C and mica) are the same. Hence adsorption is not a sp. phenomenon.

G. L. CLARK

The activity of graphite and diamond; modifications of amorphous carbon. F. J. NELLENSTEYN. *Chem. Weekblad* **22**, 291-5 (1925).—It was found that purified, ash-free, natural graphite does not adsorb methylene blue, but takes up noticeable quantities of succinic acid. Diamond powder adsorbed after purification small amts. of methy-

lene blue and no succinic acid. The very strongly varying, sometimes selective, adsorptive behavior of different sorts of amorphous C is for these reasons explained by either graphite (aromatic) or diamond (aliphatic) structure of the constituent C; there is no reason to assume a third (micro) cryst. structure. C black (methane soot) behaves in a manner analogous to diamond, activated anthracite like graphite. For the adsorption of succinic acid (also of sugars) the value of $1/n$ in Freundlich's adsorption isotherm is greater for the aliphatic type, a factor of great practical importance. So-called inactivity of adsorbing C is mostly due to impurities covering the surface.

B. J. C. VAN DER HOEVEN

Capillarity and wetting. KARL SCHULTZE. *Kolloid-Z.* 37, 10-7(1925); c.f. *C. A.* 16, 1495; 19, 197, 1977.—The terms "open" and "closed" capillaries have been used with different meanings by S. and Wo. Ostwald. It is suggested that "capillary space" (*Kapillarraum*) be used to designate openings of capillary dimensions completely shut off from the outside by solid walls. The prefixes "open" and "closed" would then refer only to the cross section of the capillary. A circular cross section belongs to a *closed capillary*; a cross section of any other shape belongs to an *open capillary*. When 2 or more open capillaries each of simple geometric form are connected a *mixed capillary* is formed. Capillary rise will be higher in any open capillary than it is in a closed capillary of the same cross section or of the same perimeter. Three tables of data show the relations between capillary rise, area of cross section and perimeter of cross section in open and in closed capillaries. The area and perimeter of open capillaries were obtained by photographic magnification. The height of rise in a mixed capillary is influenced not only by the cross section at the level of the meniscus but also by the cross section of the capillary a short distance above the meniscus. This may be shown by comparing the behavior of a closed and a mixed capillary on bending each into a siphon. Much of the H_2O in a mixed capillary is held on the walls of the tube and in the angles even when air from a suction pump is drawn through it. One tube retained more than 72% of its total capacity when lying on its side and 61% when vertical. Phenolphthalein, asphalt varnish and layers or rods of metal were coated on the inner walls or inserted into the capillary. Various solvents were used and the capillary behavior noted. The results were detd. by the effect of the substance to be dissolved on the shape and size of the capillary and on the surface tension of the solvent; by the formation of gas; and by the crystn. of salts in the tube. An open capillary will not readily fill with a liquid when the lower end is sealed. With care liquids of low surface tension can be introduced, while liquids of high surface tension, such as water, cannot be. Mixed capillaries sealed at the lower end readily fill with liquids. Capillaries lying with the closed end slightly lower than the open end fill in a manner similar to vertical capillaries. When the most acute angle is deepest the position is most favorable for filling. The sp. wetting of both H_2O and alc. is high, that is both give a contact angle of 0° and equally drive the air from a smooth glass surface. The effective wetting of H_2O is small because it imprisons air in capillary pockets and its high surface tension prevents the escape of such air. The effective wetting of alc. is high because its low surface tension allows air imprisoned in capillaries to escape. There is a definite relation between the size, form and position of the capillary and the mass of liquid entering in a unit of time.

F. E. BROWN

The use of problems in teaching colloid chemistry. F. O. ANDEREGG. *J. Chem. Education* 2, 780-1(1925).

E. J. C.

Hydration of ions, colloids and gels. N. R. DHAR. *Z. Elektrochem.* 31, 261-33 (1925).—An excellent review of the recent literature, including bibliography.

B. J. C. VAN DER HOEVEN

Dialysis of easily decomposed colloid systems. A. GUTBIER. *Z. anorg. allgem. Chem.* 146, 411-2(1925).—The inside of the semipermeable bag, as well as the outside liquid, are covered by an oil layer. For small quantities the membranes of Schleicher & Schüll are found satisfactory, but for greater vols. the app. of Mayer (*C. A.* 16, 8559) is recommended.

JOHN T. STERN

Rhythmic crystallization of sodium sulfate in thin agar-agar films. F. O. ANDEREGG AND G. W. DAUBENSPECK. *Proc. Indiana Acad. Sci.* 34, 171-6(1925).—When 0.25 M Na_2SO_4 soln. in 1% agar-agar is allowed to spread out in a thin layer on a glass plate dendritic growths may be observed to form rhythmically as the water evaporates. Supersatn. plays a part more obviously important than in most other Liesegang phenomena. The agar-agar should be kept as low as consistent with good gel formation. Too much salt produces coagulation of the gel interfering with the rhythmic effect. Different forms of growth are observed according to conditions. Light increases the rhythmic rate. Too rapid drying spoils the rhythm. Fricke's analysis (*C. A.* 18, 926) can be applied to these observations. NaCl and $CuCl_2$ give fern-like growths

CuSO_4 gives bands. K_2SO_4 does not form bands but often grows into a shape like a pair of ice tongs. F. O. ANDEREGG

Sensitivity and protective action through lipoids. W. BECK. *Biochem. Z.* **156**, 471-81 (1925).—Positively charged Fe_2O_3 sol and negative Mo_2O_5 sol can be rendered more sensitive to pptn. by electrolytes by addn. of lecithin sol or cholesterol sol. Congo red sols contg. lecithin are more sensitive than lecithin sols whereas Congo red sols contg. cholesterol are less sensitive to pptn. Congo red sols with a mixt. of 0.5% lecithin and 0.5% cholesterol are less sensitive than the original lipid mixts. F. A. CAJORI

A method for the technical preparation of colloidal ferric hydroxide sol. G. STADNIKOV AND N. N. GAVRILOV. *Kolloid-Z.* **37**, 40-6 (1925).—Colloidal $\text{Fe}(\text{OH})_3$ has been proposed as a com. coagulator of peat. A cheap and convenient method of prepn. is necessary. The simplest method seems to be the oxidation of $\text{Fe}(\text{HCO}_3)_2$ formed by the action of CO_2 on Fe immersed in H_2O . Cl_2 or HOCl would be suitable oxidizing agents. A concn. of 0.04% Fe is necessary to coagulate the peat. Expts. were carried out between 6.5 and 15°. CO_2 was bubbled through a glass tube contg. 2000 g. of Fe-nails having 5000 sq. cm. of surface and covered by 900 cc. of H_2O . The rates were 0-30 l. per hr. The amt. of Fe dissolved increased with increasing rate of flow of CO_2 . One tube contained nails freshly treated with acid. The rate of soln. in this tube was double that in a tube contg. untreated nails. The concns. of Fe increased slowly after a concn. of about 0.08% was reached in tubes contg. untreated nails. Oxide of Fe dissolves more readily than Fe. A mixt. of CO_2 and air in equal vols. gives a more rapid soln. than CO_2 alone and is better than 3:1 or 1:3. When CO_2 :air::1:3 the concn. of ferrous Fe remains about 0.016. In this case suspended ferric-Fe is present. A reservoir was filled with waste Fe from a machine shop and 25,000 l. of water to cover the Fe. Smoke whose CO_2 content was 14-15% was bubbled through the reservoir. In 4 hrs. and 40 min. the concn. of Fe in the H_2O was 0.0395%. F. E. BROWN

Preparation of colloidal ferric hydroxide solution by oxidation of ferrous bicarbonate. N. N. GAVRILOV. *Kolloid-Z.* **37**, 46-50 (1925); cf. preceding abstr.—Ordinary methods of prepg. $\text{Fe}(\text{OH})_3$ sols produce some sol. substance which must be removed by dialysis before the properties of pure $\text{Fe}(\text{OH})_3$ sol can be detd. When $\text{Fe}(\text{HCO}_3)_2$ is oxidized by Cl_2 or HClO the necessary peptizer is formed in the soln. and the colloid is ready for investigation immediately. $\text{Fe}(\text{HCO}_3)_2$ may be oxidized by bubbling O_2 or air through its soln. Just (C. A. **2**, 359, 3180) writes the equation, $d[\text{Fe}(\text{HCO}_3)_2]/dt = K(\text{Fe}(\text{HCO}_3)_2/\text{CO}_2/\text{CO}_2)$, for the oxidation of $\text{Fe}(\text{HCO}_3)_2$ by O_2 . When air is bubbled through a soln. of $\text{Fe}(\text{HCO}_3)_2$ at the rate of 30 l. per hr., and the reaction is calcd. as a first order reaction, K becomes const. after about 30 min. When HCl , sufficient to peptize the $\text{Fe}(\text{OH})_3$, is added before oxidation it reacts with the $\text{Fe}(\text{HCO}_3)_2$ and forms FeCl_2 . Only the remaining $\text{Fe}(\text{HCO}_3)_2$ is oxidized, and since FeCl_2 does not peptize $\text{Fe}(\text{OH})_3$, a ppt. results. When FeCl_3 in small amts. is added to a soln. of $\text{Fe}(\text{HCO}_3)_2$, $\text{Fe}(\text{OH})_3$ ppts. and FeCl_2 remains in soln. When 0.103% Fe as $\text{Fe}(\text{HCO}_3)_2$ and 0.060% Fe as FeCl_3 are brought together in soln., CO_2 is evolved and a soln., first dark red and later brick red, forms. Titration with iodine reveals no ferrous iron until the soln. is acidified. After acidification, titration with I shows 0.076% ferrous Fe. Passing air or O_2 through this soln. does not change the amts. of ferrous or ferric Fe. These phenomena are due to the formation of ferrous oxychloride. $\text{Fe}(\text{HCO}_3)_2$ oxidized by H_2O_2 forms an opaque white suspension which settles slowly and can be peptized by FeCl_3 or HCl . As little as 7% of the Fe content present as FeCl_3 will peptize 93% present as $\text{Fe}(\text{OH})_3$. F. E. BROWN

Preparation of colloidal silver by reduction with chloroform. V. MORÁVEK. *Chem. Listy* **19**, 195-203 (1925).—Eight millimols. AgNO_3 , 435.2 millimols. NH_4OH , 50 millimols. CHCl_3 in satd. soln. with H_2O , and 20 millimols. pure CHCl_3 mixed with H_2O to a total vol. of 12.5 cc., gelatin being added in the ratio of $\text{Ag}/\text{gelatin} = 0.11$ (presumably by wt.), are heated at 90° for 15 to 20 min. After dialysis the colloid formed during the reaction is dried *in vacuo*. It is completely sol. in H_2O . NaOH or KOH added to the reaction mixt. accelerates the process. F. C. KRACEK

The appearance of the Tyndall phenomena in gas-filled tungsten lamps. H. ALTERTIUM AND R. BECKER. *Z. tech. Physik* **6**, 306-9 (1925).—The ultramicroscopic parts consist of W. oxides, which are formed by reaction of the wire with O_2 or residual H_2O vapor. The methods by means of which the particles may be caused to disappear have been investigated. From the fact that the fog exists up to 4 days, it is concluded that the particle size is about $2 \cdot 10^{-6}$ cm. J. H. PERRY

The "Bhatnagar-Mathur-effect" of water on especially dry pressed silicic acid

gel. I. S. S. BHATNAGAR, MATA PRASAD AND DURGA DAS OHRI. *Kolloid-Z.* **37**, 97-101 (1925); cf. C. A. **16**, 3242.—Equal vols. of 12.5% Na_2SiO_3 and of 19% $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ were poured together and the resulting gel cast in a glass cylinder 2.25 in. in diam. The gel solidified easily and uniformly. It was pressed with a piston on which weights were placed and left for 48 hrs. It was then tough and could be removed from the mold. When dried for a week in vacuum desiccator it was almost as hard as agate and transparent, but crumbled whenever any one of several liquids came in contact with it. The liquids tried were H_2O , Et_2O , C_6H_6 , $\text{C}_{10}\text{H}_{16}$, 10% AcONH_4 soln., 12.5% Na_2SiO_3 soln., 20% NaCl soln., dil. NaOH soln., EtOH , $\text{C}_3\text{H}_7(\text{OH})_3$, and dil. HNO_3 soln. The temps. were between 15° and 24° . The change in temp. on the addn. of the liquid never exceeded 0.35° rise or 0.30° fall. No evidence of chem. or solvent action is present in any case, and many of the liquids are incapable of reacting with or dissolving silica gel. The crumbling is ascribed to the pressure exerted in the capillaries, by the adsorbed liquids. F. E. BROWN

Theories of Liesegang ring formation. N. R. DHAR AND A. C. CHATTERJI. *Kolloid-Z.* **37**, 2-9 (1925); cf. C. A. **16**, 3782; **18**, 1075, 2630.—Gelatin mixed with dichromate peptizes Ag_2CrO_4 more than gelatin mixed with AgNO_3 . Some sols are adsorbed by the freshly ppt. corresponding solid. The basic idea of the theory is that Liesegang rings form by the coagulation of a peptized sol, and that the coagulated mass adsorbs and coagulates the same substance from the adjacent space while it is coagulating. As_2S_3 , MnO_2 , BaSO_4 , $\text{Ni}(\text{OH})_2$, HgO , $\text{Co}(\text{OH})_2$, $\text{Fe}(\text{OH})_3$, HgS , ZnS and FeS may be adsorbed and coagulated in this way, while CdS , Sb_2S_3 and Ag_2S may not. This leads to the formation of Liesegang rings of 2 types. The first type is composed of rings of ppt. and alternate clear zones which are almost free from the substance which forms the rings. Substances whose ppts. adsorb their own kind of sols form this kind of rings. The second type consists of a ring of coagulated ppt. followed by a layer of peptized substance. These are formed by substances whose ppts. do not adsorb their sols. In the case of AgNO_3 diffusing through gelatin impregnated with K_2CrO_4 , Ag_2CrO_4 forms and is peptized by the gelatin. The concn. of KNO_3 finally becomes sufficient to coagulate some of the Ag_2CrO_4 . AgNO_3 passes through this layer and forms more colloidal Ag_2CrO_4 which is adsorbed by the ppt. until a band free from CrO_4 is formed. In the case of CdS formed under similar conditions alternate layers of ppt. and peptized sol form. There is no layer free from CdS . **Theories of Liesegang ring formation.** *Ibid.* **39**, 97 (1925).—The previous communication is reviewed and extended. A total of 61 references is given and the exptl. data are interpreted by this theory. Ag_2CrO_4 sols may be coagulated by a definite concn. of K_2CrO_4 . If the concn. is too large or too small a yellow sol results. If a protective colloid strongly peptizes a slightly sol. substance and none of the components of the reaction coagulates it, no Liesegang rings will form. If the protective colloid has a peptizing effect too weak, no rings form. PbCrO_4 and Ag_2CrO_4 are not peptized appreciably by silicic acid and form no Liesegang rings in silicic acid gels. Both peptization and coagulation are necessary for the formation of Liesegang rings. F. E. BROWN

Precipitates with stratified structure. P. P. VON VEIMARN. *Kolloid-Z.* **37**, 78-88 (1925).—Rhythmic banded ppts. may form in many ways. Only one is considered in this paper, that due to the evapn. of a colloidal soln. There is a period of time between the inoculation of a supersatd. soln. and the appearance of a ppt. In some cases this is very brief. Such salts form Liesegang rings so close together that they cannot be detected as separate layers. The presence of a "dispersator" or peptizing agent delays the formation of a ppt. When colloidal Au is formed and the solvent is evapn. from a conical vessel, Liesegang rings form on the walls of the vessel. This is due to a skin-like ppt. forming on the surface of the soln. Further evapn. leaves some of its edges adhering to the glass and below a vacant space on the glass a contact again forms. The concn. of the peptizing agent in the interior of the liquid is sufficient to change any larger particles into the colloidal condition. Some particles fall to the bottom and form a ppt. there. As evapn. continues, the concn. of both the colloid and the "dispersator" increases. Finally, the concn. of the colloid becomes so great that a ppt. forms in the body of the soln. The ring formation is due to periodic changes in the concn. of "dispersator" and of colloid. F. E. BROWN

Densities and viscosities of arsenic trisulfide sols. A. BOUTANIC AND R. SIMONET. *Bull. Soc. acad. roy. Belg.* [v], **10**, 150-4 (1924).—Stable As_2S_3 sols contg. up to 300 g. per l. may be obtained by dissolving successive quantities of As_2O_3 and passing H_2S through the soln. after each addn., eliminating much of the water under greatly reduced pressure, and removing any large particles then present by energetic centrifuging. The d. of these sols varies linearly with the concn. up to about 9%, but subsequently

increases more rapidly (cf. Linder and Picton, *J. Chem. Soc.* **67**, 71(1895)). If η and η_0 represent, resp., the viscosities of the sol and of the dispersive medium, both at 20° , and ϕ the ratio between the vol. of the disperse substance and of the suspension, the value of $k = (\eta - \eta_0)/\eta_0\phi$ approaches 2.5 as the diln. approaches infinity (cf. Einstein, *Kolloid Z.* **27**, 137(1920)). B. C. A.

Colloidal bismuth. A. GUTBIER AND THEO KAUTER. *Z. anorg. allgem. Chem.* **146**, 166-78(1925).—In view of the use of Bi for medicinal purposes, expts. were made on the protective action of gelatin, tubera salep and gum arabic. These colloidal Bi sols. are prepd. from pure $\text{Bi}(\text{NO}_3)_3$ by use of $\text{Na}_2\text{S}_2\text{O}_3$ in presence of glycerol, and dialyzed. Gum arabic gives the most const. sols., the dried colloid contg. up to 36% Bi and 2.3% S and being reversible. JOHN T. STERN.

Ferric hydrosol as a carrier of electricity. H. PUIGGARI. *Andes asoc. quim. Argentina* **13**, 23-31(1925).—Using a current of less than 0.0100 amp. the wt. of coagulum produced is directly proportional to the current. With very small currents below 0.0003 amp. the pptn. of coagulum is not perceptible, and passage of electricity is accelerated by heating the ferric hydrosol. F. M. SMMES

Physico-chemical analysis of oxide sols. A. LOTTERMOSER (WITH F. FRIEDRICH, H. M. HÜBNER AND A. SZABÓ). *Z. Elektrochem.* **30**, 391-3(1924).—The ultrafiltration of sols of chromic, ferric or Al hydroxide peptized with the corresponding chloride gives an ultrafiltrate that contains only HCl and the H-ion concn. of which is the same as that of the sol; the micelles therefore retain chloride ion, the negative charge on which compensates the positive charge on the colloid particles and the original sol may be formulated as $[(x\text{Fe}_2\text{O}_3 \cdot y\text{HCl} \cdot z\text{H}_2\text{O})\text{H}^+]_n + n\text{Cl}^-$. The sp. conductance of the sol is higher than that of the ultrafiltrate, the difference being the true cond. of the micelles which may thus be considered as complex electrolytes, the equiv. cond. of which at infinite diln. may be calcd. from the equation, $\Lambda_{m\infty} = 1000K_m/c_K$, where K_m is the cond. of the micelles and c_K that of the free chloride ion. The mobility of the micelle cation, $(1000K_m/c_K) - l_a$, rises abnormally with increasing diln. in sols. contg. little Cl because of displacement of the adsorption equil., but in sols contg. much Cl $\Lambda_{m\infty}$ approaches a const. as the sol more nearly approximates to a true electrolyte. B. C. A.

The limited significance of the hydrogen-ion concentration for the condition of lyophilic sols. H. R. KRUYT AND H. C. TENDELOO. *Verslag. Akad. Wetenschappen Amsterdam* **34**, 408-16(1925).—It is shown by means of viscosity measurements around the isoelec. point of gelatin sols, that a discharging and charging effect, completely similar to that of H-ions, can be caused by any other kind of ions. This means that the place of the viscosity min. on the p_H scale is dependent upon the neutral salt concn. Starting with isoelec. gelatin and keeping the soln. on the isoelec. p_H , the viscosity is increased by the addn. of any salt; below the isoelec. p_H addn. of salts with multivalent pos. ions ($\text{Co}(\text{NH}_3)_6\text{Cl}_3$, BaCl_2) gives an increase, addn. of all other salts a decrease and min. followed by an increase in the viscosity. The reverse effect is obtained above the isoelec. p_H with multivalent neg. salts. The characteristic min. in the property, curve of gelatin sols is not detd. solely by p_H , but is influenced as well by other ions; H ion only has a certain quant. preëminence. This work corroborates the authors' opinion that lyophilic sols have had to be considered from the same standpoint as suspensions. Also in *J. Phys. Chem.* **29**, 1303-11(1925). B. J. C. VAN DER HOEVEN

Determination of mobility of colloidal particles by means of cataphoresis. A. F. GERSIMOV. *J. Russ. Phys.-Chem. Soc.* **54**, 818-28(1924).—The app. consists of a U-tube, one leg of which is wider than the other. The electrode of sign opposite to that of the colloid is placed in the wider leg. A soln. of an electrolyte of same cond. as the colloid is poured into each leg of the tube above the colloidal soln. to a depth sufficient to touch the electrodes. Such p. d. is applied at the electrodes that the motion of the particles is of the order of 1 cm./hr., for otherwise mixing of layers during the expt. occurs. By plotting the results the most significant set of values can be selected by rejecting certain values at the beginning of the expt., and after the coagulating influence of the electrodes has begun. The most reliable values are obtained in the wider leg of the tube. Expts. have shown that mobility of collargol particle is independent of the electrolyte when it moves behind the anion, and that such dependence is quite clear when it moves before the anion. In general at the pos. end only the pos. ions, and at the neg. end the neg. ions affect the mobility of the collargol particle. These particles have greater mobility in the more concd. solns. than in the more dil. The effect of age of collargol on its mobility has not been found to be appreciable. A. C. ZACHLIN

The electric charge of difficultly soluble substances. L. MICHAELS AND SH. DOKAN. *Kolloid Z.* **37**, 67-72(1925).—On the basis of electrochemistry, colloids have been classified as acidic, basic and amphoteric. They may be classified on another basis

as obligatory and facultative. Obligatory colloids are those whose substances cannot exist as a true soln. in H_2O . Facultative colloids are composed of substances which have a true soly. in water. The facultative colloid is composed of solid particles suspended in its own satd. soln. In the field of the obligatory colloids, as with electrolytes, the H ion and OH ion have a peculiar relation in that they are dissociated to a smaller degree than other ions. In the case of facultative colloids this is often not the case; H_2SO_4 and $BaSO_4$ are examples. The charging of facultative colloids by adsorption was investigated. Comparative strengths of charges were detd. by comparing the amt. of electroendosmose under carefully regulated conditions. $HgCl$, $CaCO_3$, $BaCO_3$ and $BaSO_4$ were powd., 2 g. of the powder shaken with 500 cc. of the soln. to be investigated, filtered the next day, and put into the app. for electroendosmose. With $BaSO_4$ suspension solns. of $NaOH$, Na_2CO_3 , $Ba(OH)_2$, $BaCl_2$, K_2SO_4 in concns. from $1/300$ to $1/8000$ N, H_2SO_4 in concns. from $1/50$ to $1/8000$ N, KI , KBr , KCl , $KSCN$, $K_3Fe(CN)_6$, $K_4Fe(CN)_6$, HCl , $ZnCl_2$, $MgCl_2$, $CdCl_2$, $CaCl_2$, $SrCl_2$, $[Co(NH_3)_6]Cl_3$ and $CeCl_3$ were used. In general whenever either ion forming the micelle was present in excess it was adsorbed. Foreign ions were adsorbed. The most effective influence on their adsorption was high valence. The next was the in soly. of the salt formed by their union with the oppositely charged ion of the micelle. A third unknown factor modifies these two.

F. E. BROWN

The determination of the granular size of tungsten powder. K. AGRE, H. SCHÖNBORN AND K. SCHRÖTER. *Z. tech. Physik* 6, 293-6 (1925).—Particle size detn. by means of (1) dye adsorption method, (2) the detn. of the velocity of resolution, (3) the velocity of fall and (4) microscopic measurement has been studied. The accuracy of the various methods is discussed.

J. H. PERRY

A new practical method for the determination of the viscosity of very viscous solutions (rubber solutions) by means of narrow mesh wire sieves. RUDOLF DITMAR. *Chem.-Ztg.* 49, 676-7 (1925).—The sieve is fastened to a glass tube with the aid of a brass ring. On quickly plunging the tube to a fixed depth in a vessel contg. the soln. to be measured, the time required to fill to a given mark is measured. Simplicity and ease of cleaning are the advantages claimed. The instrument is calibrated by means of a standard liquid.

EUGENE C. BINGHAM

The elasticity of ammonium oleate solutions and the variable viscosity of a two-phase system. EMIL HATSCHKE. *Kolloid-Z.* 37, 25 6 (1925).—A mixed soln. of Na oleate and K oleate has an elasticity which neither pure soln. has (cf. *C. A.* 19, 2437). NH_4 oleate solns. in low concns. have a remarkable elasticity. One can prep. NH_4 oleate by dilg. 5 cc. of concd. NH_4OH to 100 cc., and then adding 5 drops of pure oleic acid. The soln. should be shaken after each drop is added. When a vessel contg. the resulting soln. is gently rotated and then suddenly stopped, the liquid rotates, not forward, but backward, sometimes as much as 180° . This elasticity is not greatly diminished by standing and filtering. The soln. is clear and its viscosity is only 1.08 ($H_2O = 1$). The viscosity of the two-phase system $C_6H_5CH_2-CCl_4$ -rice starch, where the liquid was of the same d. as the starch, was investigated. The diam. of the starch particles was about 3μ . As the velocity of rotation increased the relative viscosities decreased. This is due to the formation of layers of solvent around each particle. Rapid rotation partially destroys this layer; quiet permits it to be rebuilt. This applies to all disperse systems but other factors may also be important.

F. E. BROWN

The effect of alkalis on the konyaku-colloid. SH. DOKAN. *Kolloid-Z.* 37, 73-8 (1925).—Konyaku-colloid is not affected by most electrolytes in concns. under 0.1 N and the valences of the ions make but little difference in their effects (cf. *C. A.* 18, 3304). Ions have 2 effects on colloids. The first is due to their adsorption. In an electrolyte-free soln. H and OH are adsorbed. When ions are added they may replace the H and OH. The second is a competition between the colloid and ions for the H_2O mols. No ion except the OH-ion has an effect on konyaku, but OH-ions in 0.005 N soln. cause a dehydration and decrease in viscosity. $Ba(OH)_2$ and $Ca(OH)_2$ have a much greater influence than equiv. concns. of $NaOH$ or KOH . A $1/10$ N $Ba(OH)_2$ soln. reduces the viscosity of a 1% konyaku sol almost to that of pure H_2O . When the sol is made alk. with 0.01 N $NaOH$ and neutral salts are added, $BaCl_2$ and $CaCl_2$ reduce the viscosity much more than $NaCl$ or KCl . When konyaku sol is subjected to electroendosmose in neutral or acid solns. it does not move. In alk. soln. it moves to the anode. The neutral sol is hydrated and unaffected by ions. When CO_2 is added to the $Ba(OH)_2$ in the sol a much greater decrease in viscosity for the same concn. occurs. This is due to the adsorption of the $BaCO_3$ on the micelles. There is always the possibility of CO_3 , PO_4 , SO_4 , etc., ions in any colloid. In acid or neutral soln. Ba and Ca salts would not ppt. in such soln. In alk. solns. such cryst. ppts. would form. The ef-

fect of the OH-ion is the indirect effect of permitting cryst. ppts. to form. These ppts. are adsorbed on the konyaku micelles. F. E. BROWN

Colloid filtration. L. ZAMARIAS. *Kolloid-Z.* 37, 50-8 (1925).—Osmotic predicates of solvation of the membrane. Ultrafiltration consists in passing the filtrate through pores. Ultrafiltration is dealt with under the heads: the support, which was unglazed porcelain, and the membrane which was deposited on the support. Capillary air in the support retards the flow of the filtrate. Passing good wetting solns. through the unglazed porcelain does not remove the capillary air. Evacuation and filling the support with air-free distd. H₂O doubles the rate of filtration. A more permeable support produces a more permeable membrane. The permeability of the filter is almost proportional to the permeability of the support, when the same collodion is used to form the membrane. The size of the pores in the membrane is detd. by the size of the pores in the support. A membrane torn loose from its support is permeable to Ag sol. The membrane over the pores in the support is free and permeable. Colloid filters may be made without a membrane, if BaSO₄ is drawn into the pores of the support. When colored colloids are being filtered, their substance can often be seen on the under side of the support while the filtrate is free from them. Protein sometimes passes through a filter which has produced a pure filtrate for an hour. The collodion soln. may be drawn into the filter and partially close the pores to make a less permeable and slower filter. If more than one layer of collodion is put on the support, the rate of filtration is inversely proportional to the no. of layers. Increase of pressure increases both permeability and rate of filtration for a hydrophile as well as for a hydrophobe collod. The effect of pressure is reversible. The weaker and thinner the collodion membrane the more permeable it is. This is because tensile strength, elasticity and permeability depend on form, thickness, state of aggregation, coherence and possibility of reaction of the micelles of the gel. A promoter of swelling widens the pores but also lengthens them. For some substances the greater length of the capillaries compensates for their greater diam. and no increase of permeability is noticed. The colloid filter with a supported membrane is an elastic sieve capable of swelling. Substances which do not undergo swelling or stretching may be colloidal filters, e. g., a porcelain plate impregnated with BaSO₄. The colloids change the capillaries of the filter, making them smaller. Colloid filtration is an adsorption filtration in colloidal capillaries. F. E. BROWN

Osmotic pressure by the solubility method in concentrated solutions. M. P. APPLEBEY AND P. G. DAVIES. *J. Chem. Soc.* 127, 1840-6 (1925).—The changes which are produced in the soly. relations of 2 partially miscible liquids when a solute is added which is sol. in only 1 of the liquids have been shown by Nernst to be connected with the osmotic pressure. This method has been applied to concd. solns. in the hope of opening up another way of approach to the osmotic relations of such solns. The behavior of PhNH₂ in H₂O-sucrose soln. was studied. Since none of the ordinary phys. properties of PhNH₂ was sufficiently sensitive to the addn. of H₂O to det. the concn. of the PhNH₂ in H₂O, direct soly. detns. were made. The following values give the % of H₂O and the temp. of satn.: 4.534, 15.9°; 4.659, 18.3°; 4.815, 20.5°; 4.926, 21.15°; 4.950, 22.6°; 5.398, 34.1°; 5.899, 43.5°; 6.104, 47.5°. Values for the osmotic pressure are given for 0, 300, 420, 540 and 660 g. sugar per 1000 g. of soln., calcd. from Nernst, from the detns. of Berkeley and Hartley (*C. A.* 14, 488) and from an equation, $P_1 = n_2/n_1[-RT \log(1-c_2) + \alpha c_2^2]$, derived by combining van Laar's equation for conc. solns. and the Beattie-Burton equation. The agreement with the direct detns. of B. and H. is fairly satisfactory up to a concn. of 420 g. per 1000 g. of soln. but considerable divergence occurs at higher concns. For the practical detn. of osmotic pressure in concd. solns., the soly. method is not yet capable of giving direct results accurately, though the van Laar integration is a step towards that end. Comparative results, however, may be obtained without undue exptl. difficulty. C. J. WEST

Freezing point curve for aqueous solutions of sodium nitrite. H. HELBERG. *Ann. chim.* 4, 421-5 (1925).—A criticism of the results of Ostwald (*C. A.* 8, 1927) on the NaNO₂-H₂O equil. at diff. temps. New data are presented showing mol. depressions of f. p. more consistent with other anhyd. binary compds. The f. ps. are detd. by careful dottle-approach. Mean values are: 5.0°, 9.1% NaNO₂; -7.0°, 12.65%; -10.0°, 16.1%; -11°, 17.35%; -14°, 20.35%; -20.5°, 30.8%. The method was checked by obtaining values for NaNO₃ conforming to those established by Landolt-Bornstein. JOHN T. MCCOY

Solubility of silver in water. I. Preliminary communication. H. KREPELKA AND F. TOUL. *Chem. Listy* 19, 182-4 (1925).—Preliminary expts. on the soly. of Ag in H₂O carried out with at. wt. detn. precision indicate that 1 l. of H₂O dissolves in 7 days approx. 0.609 mg. Ag. F. C. KRACÉK

The mechanism of chemical reaction. R. C. TOLMAN. • *J. Am. Chem. Soc.* **47**, 1524-53 (1925).—Assuming that the rates of chem. reactions are dependent on activated mols., there are 4 proposed mechanisms of activation considered: (a) by collision with another mol. of high kinetic energy, (b) by collision with another mol. which is itself an activated state, (c) by the absorption of monochromatic radiation, (d) by interaction with more than 1 frequency of radiation. These 4 modes are tested by comparison with the data available on a typical uncatalyzed first order gas reaction, $N_2O_5 = N_2O_4 + \frac{1}{2}O_2$ and on a similar second order reaction, $2N_2O = 2N_2 + O_2$. Activation of the first type cannot take place fast enough to account for the decomn. of N_2O_5 or other similar reactions but might be fast enough for bimol. reactions. Activation of the second kind may be important in certain abnormal reactions but does not appear to be the primary method of activation for the reactions studied. Activation by monochromatic radiation cannot take place fast enough and leads to incorrect predictions as to frequencies which will be active. Activation by interaction with more than 1 frequency is considered the most probable mechanism; and it is suggested that instead of a single activated state there may be whole series of activated states. A. W. KENNEY

Molecular contraction in solutions. JITANDRA NATH RAKSHIT. • *Z. Elektrochem.* **31**, 320-3 (1925).—Tabulated data are given of the contraction occurring on dissolving CaO , $Ca(OH)_2$, $CaCl_2$, BaO , $KBrO_3$, $NaIO_3$ and $AgNO_3$ in water, toluene, CS_2 , Me_2CO , Et_2O , $MeOH$, $EtOH$, isopropanol, $EtOAc$, $CHCl_3$, $AcOH$, Ac_2O , nitrobenzene and narcotine in benzene; water in $MeOH$, $EtOH$, Me_2CO , glycerol, $AcOH$, HNO_3 and H_2SO_4 . B. J. C. VAN DER HOEVEN

Hydrogen-ion concentration. JEAN BARBAUDY. *Rev. gén. sci.* **36**, 5-17 (1925).—A review explaining the significance of p_H and describing the methods of detg. it. A. PAPINEAU-COUTURE

The standard values for calculation of p_H from measurements with hydrogen or quinhydrone electrode. I. M. KOLTHOFF. *Chem. Weekblad* **22**, 332-9 (1925).—A review. B. J. C. VAN DER HOEVEN

The cause of the color change of cobalt chloride solutions. J. GRÖH. *Z. anorg. allgem. Chem.* **146**, 305-14 (1925).—The mol. extinction coeffs. of $CoCl_2$ in propyl alc., $EtOH$, $MeOH$ and H_2O were measured by the usual spectrophotometric methods. In some solns. $LiCl$ was added with the $CoCl_2$. The concn. range covered was 0.05-0.8 M; the wave length range was 520-700 μ . The measurements support the complex ion theory of the color change from blue to red on dilution. The color change is expressed by the equation $CoCl_2 \text{ (red)} + 2Cl^- \rightleftharpoons CoCl_4^{2-} \text{ (blue)}$. In propyl alc. the dissociation of the blue complex ion $CoCl_4^{2-}$ is vanishingly small, is noticeable in $EtOH$, is marked in $MeOH$ and is complete in dil aq. soln. R. L. DODGE

Potentiometric indication of the reaction between halogen and cyanide ion. ERICH MULLER and AUGUST SCHUCH. *Z. Elektrochem.* **31**, 332-4 (1925).—On adding CN^- ion to a halogen soln. the ratio c_{x2}/c_{x2}^0 which determines the potential decreases gradually; a sudden drop occurs at the point where the stoichiometric quantity is reached (a calomel cell and a Pt electrode were used). For Cl the value of the potential drop differs according to the direction in which the reaction is led; for Br and for I it is the same in both directions. For practical use in the prepn. of $ClCN$ (Cl_2 is led into a cooled KCN soln.), the immersion electrode (cf. *C. A.* **19**, 3353) is recommended with the same filling, the potential of it is zero for equiv. amts. of Cl and cyanide. B. J. C. v. d. H.

Fractional precipitation. I. The dependence upon the solubility products, dissociation constants, modification of the precipitate, etc. OTTO RUFF and PAUL HIRSCH. *Z. anorg. allgem. Chem.* **146**, 388-410 (1925).—The sepn. of metals by fractional pptn. with $(OH)^-$, $(CO_3)^{2-}$ and $(S)^{2-}$ is studied through analysis of the yield from solns. contg. two metals, and by investigating the transformation of Mn , Cd , Ni , Fe , Zn , Pb , Cu , Ag , Cr , Al pptns. in presence of the reciprocal solns. Sepn. can generally be carried out within the limits given by the theory and formation of mixed crystals occurs seldom, while adsorption is practically negligible. J. T. S.

The influence of water on certain chemical reactions. I. The effect of various concentrations of water vapor on the reaction between chlorine and potassium iodide, and chlorine and potassium bromide. II. The reaction between hydrogen sulfide, and iodine in ether solution. III. The reactions between certain metals and iodine. L. B. PARSONS. *J. Am. Chem. Soc.* **47**, 1817-20, 1820-30, 1830-5 (1925).—Gaseous Cl_2 contg. different amts. of H_2O vapor was passed over solid KI and KBr at 20° and at 30° . A min. partial pressure of H_2O vapor at each temp. must be attained before any considerable reaction takes place. This min. pressure is approx. the vapor pressure of a satd. soln. of the components present during the reaction. The reaction between H_2S and I_2 in ether soln. depends upon whether or not H_2O is present. In the absence of H_2O the

reaction is complete, $\text{H}_2\text{S} + \text{I}_2 = 2\text{HI} + \text{S}$. In the presence of H_2O an equil. is reached, and the reaction appears to be $\text{H}_2\text{S} + 3\text{H}_2\text{O} + 3\text{I}_2 = \text{H}_2\text{SO}_3 + 6\text{HI}$. Diffuse daylight has no appreciable effect on the reaction, but atm. O_2 changes its course considerably. Exptl. on mixts. of I_2 with a variety of finely divided metals in the presence of different liquids show that where H_2O or other liquids bring about a reaction which does not take place in their absence, it is due to the fact that the liquids dissolve the film of solid iodide from the surface of the metal.

A. W. KENNEY

The nature of non-dissociated acids. H. V. HALBAN. *Z. Elektrochem.* **31**, 454-5 (1925); cf. *C. A.* **19**, 1366, 1643.—Polemical.—A. HANTZSCH. *Ibid.* 455-6; cf. *C. A.* **19**, 1366, 2293.—Reply.

JOHN T. STERN

Dissociation constant of methanol. NIELS BJERRUM, AUGUSTA UNMACK AND FASZLO ZECHMEISTER. *Kgl. Danske Videnskab. Selskab. Math. fys. Medd.* **5**, No. 11, 34 pp. (1925).—MeOH dissociates according to the equation $\text{MeOH} = \text{MeO}^- + \text{H}^+$ (1). The alternative mechanism, $\text{MeOH} = \text{Me}^+ + \text{OH}^-$ (2) must take place with inappreciable velocity if at all, since combination of the two processes would yield H_2O and Me_2O and no formation of ether in MeOH has been detected. Measurements show that the dissociation of MeOH according to (1) leads to a well defined equil. The dissociation const. has been detd. by the authors by 2 independent methods, viz. (1) by measuring the e. m. f. of acid-base cells, employing MeOH as solvent, and calcg the dissociation const. according to the method employed by Arrhenius (*Z. physik. Chem.* **11**, 805 (1893)) and Ostwald (*Ibid.* **11**, 521 (1893)) for H_2O , and (2) by measuring the alcoholysis of some salt of a weak acid and base, in MeOH. The cell $\text{H}_2 | \text{HCl} | \text{NaCl} | \text{MeONa} | \text{H}_2$, MeOH used as solvent, at 18° was employed for the calcn. by the 1st method, and yielded values $\log_{10} K_{\text{MeOH}}^\infty = -16.97$ at 18° , -16.66 at 25° and -16.15 at 37° . The change of $\log_{10} K_{\text{MeOH}}^\infty$ with temp. for a 0.1 M soln. yields 12,000 cal. for the heat of dissociation, as compared with 13,700 cal. for H_2O . The alcoholysis of AcONH_4 in MeOH was used for the 2nd method of calcn. and, incidentally, the dissociation const. of AcOH and MeONH_4 detd., since these are needed in the calcn. It was found that $\log_{10} K_{\text{alc.}} = -1.48 - 1.80 \sqrt{C}$, $\log_{10} K_{\text{NH}_4\text{OMe}}^\infty = -5.92$, and $\log_{10} K_{\text{AcOH}} = -9.65 + 1.77 \sqrt{C}$ at 18° . Hence, $\log_{10} K_{\text{MeOH}} = -17.05$ at 18° , since $K_{\text{MeOH}} = K_{\text{alc.}} K_{\text{NH}_4\text{OMe}} K_{\text{AcOH}}$. The agreement between the 2 independent methods is excellent.

F. C. KRACKER

The dissociation constants of selenious acid. J. S. WILLCOX AND E. B. R. PRI-DEAUX. *J. Chem. Soc.* **127**, 1543-6 (1925).—Both dissociation const. of H_2SeO_3 were redetd. (cf. *C. A.* **14**, 2287) by adding measured vols. of 0.189 M NaOH soln. to 20 cc. of 0.05 M H_2SeO_3 in the presence of suitable indicators. The colors were matched in Nessler glasses, against those of solns. obtained by the addn. of the same alkali to 20 cc. of the British Drug Houses universal indicator. By this method the H-ion concns. corresponding to each 3% of H_2SeO_3 neutralized were calcd. The mean values of the dissociation const. K_1 and K_2 calcd. from these data are $K_1 = 4.0 \times 10^{-3}$ and $K_2 = 0.87 \times 10^{-8}$. The p_H values for the end points of the titrations are for NaHSO_3 , $p_H = 5.23$ and for Na_2SeO_3 , $p_H = 10.35$. Suitable indicators for the first titration are *p*-nitrophenol, cochineal, lacmoid and resazurin. Fair results for the second titration have been obtained with thymolphthalein.

R. L. DODGE

Mobility of ions in solid cuprous sulfide. H. BRAUNE AND O. KAHN. *Z. physik. Chem.* **112**, 270-6 (1924); *Science Abstracts* **28A**, 331.—Measurements of the coeff. of diffusion of Ag ions in solid Cu_2S contg. a little Ag_2S at various temps. between 223° and 919° indicate that the Ag ion possesses very considerable mobility, the values obtained for the coeff. being expressed by the equation, $D = 113e^{-2286/T}$. On the other hand, Cu_2S contg. a small addn. of cuprous selenide shows at 230° no appreciable diffusion of Se ions.

H. G.

The velocity of the reaction $2\text{NO} + \text{Cl}_2 \rightarrow 2\text{NOCl}$ in the condensed condition. MAX TRAUTZ AND WILHELM GERWIG. *Z. anorg. allgem. Chem.* **146**, 1-41 (1925); cf. *C. A.* **18**, 3306.—The soly. of NO in NOCl, pentane and toluene is detd. at -58° by vapor-pressure measurements; also the m. p. diagram of Cl_2 while absorbing NO. This shows evidence of NOCl_2 . In special app., extensively described, the velocity of NO adsorption by liquid Cl_2 was detd. The results obtained were in contradiction to van't Hoff's partition according to the respective solubilities.

JOHN T. STERN

The theory of reaction rate. G. N. LEWIS AND D. F. SMITH. *J. Am. Chem. Soc.* **47**, 1508-20 (1925).—The theory that the rate of chem. reactions depends on the concn. of activated mols. is discussed; activated mols. are defined as those possessing more than a min. energy, which in turn is defined as the heat of activation. It is shown that an equation of the type $d\ln K/dT = q/RT^2$, where K is the rate const. and q the heat of

activation, is exactly true in certain simple cases and is, in all cases, an approximation which becomes more exact for higher heat of activation and for lower temps. Both collisions and radiant energy offer opportunities for the activation of mols. far greater than the no. required for observed reaction rates. It is suggested, on the basis of Rayleigh's work, that the area of cross section of a light quantum is $\lambda^2/8\pi$, and this leads to an equation for the no. of encounters between mols. and the quanta of light which possess sufficient energy to activate them. There is no sound objection to the general radiation theory of activation, but the special theory which assumes activation by nearly monochromatic light must be abandoned.

A. W. KENNEY

The reduction mechanism of iron oxides in a gas stream. II. KONRAD HOFMANN. *Z. angew. Chem.* **34**, 715-21 (1925).—The blast-furnace process is imitated in a simplified manner, pure H gas and various Fe_2O_3 and Fe_3O_4 preps. being used. The reaction products are analyzed and the results given in curves of H absorption in relation to time and % reduction in relation to temp. Equil. reactions as investigated by Levin and Nieldt (*C. A.* **6**, 207) indicate only the tendency of the reaction, because the result is letd. by the surface conditions. Fe_2O_3 shows 100% reduction at 550° and 1000°, with minima at 750° (a) and 925° (b). Canules of 0.05-0.02 mm. diam. are best. Fe_3O_4 exhibits the same character, but is harder to reduce (ferric ferrate). FeO was not found below 564°. Fe_3O_4 forms only in slow processes. The reduction minima are explained (a) by adhesion and (b) by the β - γ transformation. They can be suppressed by addn. of MgO. Acid admixts. (SiO_2) do the same, but form unreducible slag above 700°.

JOHN T. STERN

Kinetic theory of compressibility of solutions and binary fluid mixtures. K. C. KARR. *Physik. Z.* **26**, 465-7 (1925).—With the aid of statistical mechanics, new formulas are derived for the variation of concn. with compressibility. Observed values and values calcd. from the relation $\beta_\chi(1 + \chi^2) = \beta_0$ (where β_χ is the compressibility of the soln. at the concn. χ and β_0 that of the soln. medium), are found to be in substantial agreement. Data are given for several inorg. salts and the fluid mixts. $\text{CS}_2 + \text{EtOH}$ and $\text{H}_2\text{O} + \text{Me}_2\text{O}$. This knowledge of compressibilities will permit an estn. of light scattering by individual mols. with the aid of Einstein's equation. H. R. MOORE

Reactions in ionization and catalysis. I. M. KOLTHOFF. *Chem. Weekblad* **22**, 356-7 (1925).—Lecture demonstrations. B. J. C. VAN DER HOEVEN

The catalytically active and inactive forms of ferric oxide. L. A. WELSH and OSKAR BAUDISCH. *J. Biol. Chem.* **65**, 215-27 (1925).—The following forms of iron oxides were prepd.: (A) magnetite, by pouring a soln. of 1 mol. FeSO_4 and 1 mol. $\text{Fe}_2(\text{SO}_4)_3$ into a boiling soln. of NaOH; (B) magnetite, by adding a soln. of 2.55 g. KNO_3 to a boiling mixt. of 220 cc. 10% $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ and 22 g. of 20% NH_3 ; (C) magnetite, by pouring a soln. of 9 g. $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ into an O_2 -contg. soln. of 2.6 g. NaOH and 20 g. KNO_3 . These were all washed by decantation, filtered and dried in desiccators. (D), (E) and (F) were ferric oxides prepd. by heating (A), (B) and (C), resp. in a stream of O_2 at 330°. (G), (H) and (I) were prepd. by heating these oxides to 550° or the magnetites to 550° in a current of O_2 . These were compared for their activity in accelerating the oxidation of benzidine by H_2O_2 , in accelerating the growth of *Bacillus leptosepticum* and in increasing the O_2 -absorption of broth or H_2O -cultures thereof. (A) was much more active than either (B) or (C). (D), although it contained no Fe'' , was as active as (A). X-ray examn. showed that (A), (B) and (C) had the same intramol. arrangement but that the crystals of (A) were smaller. (D), (E) and (F) had the same crystal form as (A), (B) and (C), but the crystals of the hematites had a different form. The activity seems to depend upon the size of the crystals and upon the intramol. arrangement and not upon the presence of Fe'' nor on the absorptive capacity. Hematite could absorb 97% of its wt. of H_2O .

I. GREENWALD

Sulfuryl chloride. III. The influence of catalysts on the chlorination of toluene. OSWALD SILBERRAD, CHAS. A. SILBERRAD and BEATRICE PARKE. *J. Chem. Soc.* **127**, 1724-31 (1925); cf. *C. A.* **16**, 15, 2851.—The catalytic chlorination of PhMe by SOCl_2 was studied with 2 kinds of catalysts: (1) those that either inhibit chlorination or alter its course without inducing any appreciable acceleration, and (2) those that accelerate substitution. Nineteen catalyst materials were studied, including AuCl_3 , AlCl_3 , C, SnCl_4 , PCl_5 , As, Sb, Li, S_2Cl_2 , Se, Te, Mn, Cl_2 , Br, I, Fe and Pt. Of these only PCl_5 , MnCl_3 and As were of the 1st kind, acting in this order to prevent ring substitution, and to increase the quantity of PhCH_2Cl produced in a given time. All the other catalysts accelerated ring substitution, and, with the exception of S and Br, at the expense of PhCH_2Cl . Further, the catalytic activity of the elements, with the exception of Br, was a function of the at. wt., increasing with this apparently up to a max. The elements of the same group showed a decreasing tendency to induce side-chain substitution with

increasing at wt. The results were obtained by boiling 0.75 g. of PhMe with 10% excess SO_2Cl_2 for 8 hrs. in the presence of the catalyst. The product was then analyzed for PhMe, ClCH_2Me and PhCH_2Cl by steam distn. and fractional distn. R. L. DODGE

Reactions on ionization and catalysis. D. H. WESTER. *Chem. Weekblad* 22, 317-9 (1925).—Simple lecture demonstrations. B. J. C. VAN DER HOEVEN

Catalytic oxidation of hydrocyanic acid. RYOSABURO HARA AND HEIMA SHINOZAKI. *Tech. Repts. Tohoku Imp. Univ* 5, No. 2, 71-113 (1925) (in English).—The oxidation of HCN to NO by a Pt catalyst was studied over a temp. range of 400-1000° with mixts. of HCN and air of varying proportions. Yield-temp. and isothermal yield-gas velocity curves are given. The oxidation begins at about 500° and reaches a max. yield of 85-95% at about 800°. Rapid gas flow favors a high yield of NO. The optimum concn. of HCN is 4-8%, higher concns. giving a solid product consisting chiefly of cyanuric acid and cyanide. The mechanism of the reaction is considered as consisting in the oxidation of HCN to HCNO and the further oxidation of this product to H_2O , CO and NO. With a deficiency of O, the HCNO polymerizes to $(\text{HCNO})_n$ or $(\text{HCNO})_n$. A. G.

New views of the character of catalysis. Active and inactive iron oxide. OSKAR BAUDISCH AND LARS A. WELO. *Chem.-Ztg.* 49, 661-2 (1923).—Artificial magnetite was prepd. by dissolving equiv. amts of FeSO_4 and $\text{Fe}_2(\text{SO}_4)_3$ in H_2O and poured into an excess of hot NaOH. The black ppte was centrifuged and washed with water until entirely neutral. By centrifuging, a brown-black powder was obtained; this was dried in a steam oven. From this magnetite two entirely different oxides (Fe_2O_3) could be obtained. Active Fe_2O_3 was obtained by heating in O_2 to 330°; the inactive, by heating to 550°. The X-ray spectrograms of the two oxides are entirely different, the active being of cubical structure, and the inactive, rhombohedral. The lattice of the active oxide is in a relatively labile condition and this may, under certain circumstances, pass over into the much more stable and catalytically inactive form. The magnetic susceptibilities for the active and inactive are: 0.182 and 0.0036, resp., while for true magnetite this const. is 0.152. The absorption of O_2 is 0.0080 and 0, resp., for the active and inactive varieties. H_2O absorption is 27% and 21%, resp. In the oxidation of benzidine by H_2O_2 , the active reacts well while the inactive variety gives no trace of catalytic action. Good growth of *B. lepusculum* in bouillon was obtained in the presence of the active variety, whereas with the inactive oxide no growth was observable. It is concluded that the catalytic action of the Fe depends upon the spatial arrangements of the electrons and protons in the atom. J. H. PERRY

The relation of homogeneous to catalyzed reactions. The catalytic decomposition of hydrogen iodide on the surface of gold. C. N. HINSHELWOOD AND C. R. PRICHARD. *J. Chem. Soc.* 127, 1552-9 (1925).—The heats of activation as calcd. from the temp. coeffs. of heterogeneous catalyzed reactions of zero order are true values and may be compared directly with the values for the corresponding homogeneous reactions. The rate of decompn. of HI on the surface of Au was measured by the static method previously described (cf. C. A. 19, 1805) and found to be of zero order, i. e., the absolute rate of the reaction was independent of the pressure of the reacting gas. The reaction rates were measured at temps. between 530 and 817°, with initial pressures of 50, 100 and 200 mm. H₂ and 100, 200 and 400 mm. HI. The reaction rate was uninfluenced by the presence of H. The heat of activation, as calcd. from the temp. coeffs. of the cata-

requiring an energy of activation about twice as great.

R. L. DODGE

The interaction of carbon dioxide and hydrogen on the surface of tungsten. C. N. HINSHELWOOD AND C. R. PRICHARD. *J. Chem. Soc.* 127, 1546-52 (1925).—A dynamic method for measuring heterogeneous gas reaction velocities previously described (cf. C. A. 19, 1805) was employed in studying the rate of the reaction $\text{H}_2 + \text{CO}_2 \rightarrow \text{H}_2\text{O} + \text{CO}$. The catalyst used was a W lamp filament. The reaction was rendered irreversible by the absorption of the H_2O formed in concd. H_2SO_4 in the bottom of the reaction vessel. The % CO_2 converted to CO at the end of 100, 200 and 300 sec. was measured at various temps. between 953 and 1303°, and for various ratios of initial CO_2/H_2 pressures. Assuming the simplest type of adsorption, these data are used to calc. the fraction of certain active centers on the W filament that are covered with CO_2 and H, resp. The adsorption of each gas on the active centers of the catalyst is almost independent of the pressure of the other gas. This shows that not all the surface is active, but that only certain parts are able to adsorb H and CO_2 and cause them to react. From the temp. coeff. of the reaction rate, the apparent heat of activation of this reaction, as calcd. by means of the Arrhenius formula, is 30,000 cal. R. L. DODGE

In-, mono-, and plurivariant equilibria. XXIX. F. A. H. SCHREINEMAKERS. *Ve slag. Akad. Wetenschappen Amsterdam* **34**, 306-15; *Proc. Acad. Sci. Amsterdam* **28**, 252-61 (1925); cf. C. A. **19**, 1805.—The change in temp., etc. of systems on addn. of foreign substances is theoretically discussed.

B. J. C. VAN DER HOEFEN
A simple method for representing polynary systems. V. LODOCHNIKOV. *Ann. inst. anal. phys.-chim.* (Russ.) **2**, 255-351 (1924), *Chem. Zentr.* **1925**, I, 1553-4.—A description of recognized methods for representing graphically systems with several components, in connection with which a new method is proposed. *Three independent components.*—Three independent components (Fig. 1) $AB = 1$, $AE = FG =$ the mol. fraction of the 3rd component (outside the diagram) $EP =$ that of the 1st and $PF =$ that of the 2nd component. The system is represented by the point P . If the compn. of any system is not given directly by the mol. fractions of the independent components but by the points P_1, P_2 and P_3 of the 3 initial systems comprising the final system, then the resulting point P_0 is the center of gravity of P_1, P_2 and P_3 . *Four independent components.*—Over the square $ABCD$ is located the 4th component at its proper distance vertically above P . Since, however, 3-dimensional diagrams cannot be reproduced, another method shown in Fig. 2 is recommended. $AE = HJ =$ the mol. fraction of the 4th component, $EF =$ the 1st, $FG =$ the 2nd and $GH =$ the 3rd. The system is represented by the vector FG . As the 4th component, it is well to choose the one whose const. vary most and as the 2nd, the one with the fewest const. If the 3 vectors JH, KK_1 and LL_1 are given, it can be detd. whether the system MM_1 can be constructed from the 3 initial systems. This is practicable if the points m and m_1 lie on a straight line parallel to the given vectors. The quaternary system of the type $a + b + c = d + e$ is represented by Fig. 1. The vector always lies in the direction from the terminus of the section a to the terminus of the section d . C. C. DAVIS

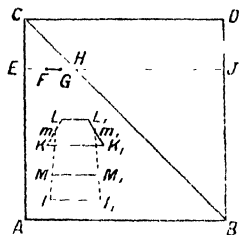
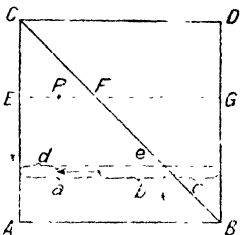


Fig. 2

Singular points of chemical diagrams. N. S. KURNAKOV. *Z. anorg. allgem. Chem.* **146**, 69-102 (1925); cf. C. A. **19**, 2158.—Theoretical paper, illustrated by examples and with an extensive bibliography. Special stress is laid on the discrimination of breaks in chem. curves, which are not singular points. "A chem. individual, which belongs to a certain chem. compd., represents a phase, which has a singular point or non-variant of the compn. in the transformation of the equil." Singular points must occur in all curves, representing the different properties of a system.

JOHN T. STERN
The equilibrium between carbon dioxide and carbonates in the three phases comprising the air, water and solid earth of the globe. R. LEGENDRE. *La nature* **53**, II, 138-42 (1925).—A discussion of the underlying causes tending to increase and those tending to diminish the CO_2 of the terrestrial atm. The existing quantity of CO_2 represents an equil. which may be regarded as the resultant of a reservoir of atm. CO_2 , another reservoir of carbonates in the earth and an intervening stratum of H_2O in which they both dissolve and react to form bicarbonates. The equil. is also influenced by the presence of chlorophyll at the surface of sepn. of the atm. and the H_2O phases, which acts as a biological membrane and diminishes the partial pressure of the CO_2 at the surface of contact. The whole subject is to be published in much greater detail shortly (cf. *La concentration en ions hydrogène de l'eau de mer. Le pH, procédés de mesure, importance océanographique, géologique et biologique.* Presses Universitaires de France, Paris, 1925). C. C. DAVIS

Equilibrium diagrams and the heats of formation in some binary organic systems. I. B. E. KITRAN. *Farmaceutski vjesnik* **14**, 583-90, 617-20, 668-74, 702-4, 748-51, 777-83 (1924).—The equil. relations in binary system: with trichloroacetic acid as the first component (C_1) have been studied by the cooling curve method. In the following summary, the compn. of characteristic m.pts. is expressed in moles % (—) of the second component (C_2). $C_1 = p$ -Toluidine; 2 eutectic points at 18.2° (15) and at 32.7° (65) and a max. at 84.0° (33.3), corresponding with the compd. $\text{Me.C}_6\text{H}_4\text{NH}_2.2\text{CCl}_3.\text{CO}_2\text{H}$. $C_2 =$ Diphenylamine; 2 eutectic points at 19.6° (15) and at 51.3° (95), and a max. at 114.2° (66.6) corresponding with the compd. $2\text{NHPh}_2.\text{CCl}_3.\text{CO}_2\text{H}$. $C_3 = p$ -Naphthylamine; 2 eutectic points at 15.0° (12) and at 98.6° (65) and a max. at (50). It was not possible to det. the m. p. o. the equimol. compd. because of the decompn. of the trichloro-

acetic acid. Results with phenol confirmed those previously obtained by Kendall (C. A. 16, 2096). Quinol: 2 eutectic points at 4.95° (2) and at 77.5° (35), and a max. at 84.9° (25) corresponding with the compd. $C_6H_4(OH)_2 \cdot 3CCl_3 \cdot CO_2H$. Pyrocatechol, resorcinol, pyrogallol and naphthalene form no compds. The data for the resp. eutectic points are: pyrocatechol, 34.7° (25); resorcinol, 25.0° (30); pyrogallol, 40.2° (12); naphthalene, 35.2° (23). C_2 = Camphor: 2 eutectic points at 6.7° (30), and at 22.3° (67) and a max. 62° (50) corresponding with an equimol. compd. The formation of this compd. is significant as it accounts for the difference in the results for the heat of combustion of trichloroacetic acid as detd. by Berthelot and Matignon (*Ann. chim. phys.* [6], 28, 565(1893)) and those obtained by K. In the second part of the paper binary systems with phenacetin (C_1) have been investigated. C_2 = Urethane: a eutectic at 45.0° (93.5); C_2 = acetanilide, a eutectic at 75.0° (78.4); C_2 = benzoic acid, a eutectic at 86.7° (65.7). The third part of the memoir deals with various binary systems. Naphthalene (C_1) gives with *m*-dinitrobenzene (C_2) a eutectic at 51.0° and 44 mol. % of *m*-dinitrobenzene. The different results of Kremann (*Monatsh.* 25, 1271-1310(1905)) are attributed to supercooling, to which the mixt. is strongly inclined. Phenol (C_1) and *p*-toluidine (C_2) form an equimol. compd., which exists in 2 forms, the metastable modification crystg. at 28.6° and the stable at 29.4° (cf. Philp, *J. Chem. Soc.* 83, 828(1903)); the eutectic points are at 9.1° (25) and at 20.8° (69). *m*-Chloronitrobenzene (C_1) and *m*-bromonitrobenzene (C_2) yield only a continuous series of solid solns. as previously found by Kuster (*Z. physik. Chem.* 8, 577-600(1892)) and Hasselblatt (C. A. 7, 2333). B. C. A.

The equilibrium pressures of gas hydrates. G. TAMMANN AND G. J. R. KRIGE. *Z. anorg. allgem. Chem.* 146, 179-95(1925).—Sulfur dioxide-hydrate in equil. with liq. and vapor below -2.6° maintains after successive pressure and temp. changes a const. vapor pressure. This shows that only one hydrate of SO_2 exists. The temp. log pressure diagram consists of 2 straight lines, intersecting at -2.6° . From the *p-t* diagram of the eutectic mixt., the compn. $SO_2 \cdot 6H_2O$ is calcd. All products sepd. out of solns. contain about 40% satd. soln. The 3-phase curve of $SO_2 \cdot 6H_2O$ and both solns. satd. with it and of the eutectic are given. Similar measurements are made on chloroform hydrate. Oxygen solns. in H_2O satd. at 0° and 1 atm. give off 90% of the gas in freezing. Equally satd. solns. of carbon dioxide give off 99.7% of the gas. The dissociation tension of $CO_2 \cdot 6H_2O$ below -40° is measured and found to follow the equation $t = 23.0 (\log p - 1.0909)$. The hydrates of N_2O , A and Kr have similar formulas, while Br_2 , Cl_2 and SO_2 hydrates have a coeff. between 40 and 50. The occurrence of gas hydrates in the atm. is discussed.

JOHN T. STERN

Equilibrium in the ternary system bismuth oxide, hydrochloric acid, water at 25°. GHULAM WARIS. *Quart. J. Indian Chem. Soc.* 1, 307-10(1925).—From a study of the ternary system Bi_2O_3 , HCl, H_2O at 25° W. concludes that anhydrous $BiOCl$ is the stable phase sepd. up to the point 33.7% HCl, 50.7% Bi_2O_3 , 7.6% H_2O . F. C. K.

The graphical representation of quaternary and quinary systems. W. ALZHAMMEK. *Kali* 19, 223-5(1925).—Methods of representing isotherms of such systems by triangular diagrams with straight lines of conjugation or quadrangular diagrams with lines of conjugation which are equilateral hyperbolas are discussed. WM. B. PLUMMER

Equilibria in systems of phases separable by a semi-permeable membrane. VII. F. A. H. SCHREINEMAKERS. *Verslag. Akad. Wetenschappen Amsterdam* 34, 297-305 (1925) cf. C. A. 19, 2158.—The no. of degrees of freedom of an osmotic equil. with *d* diffusing substances. $E_1(n_1r_1) : E_2(n_2r_2)$ is found to be $n_1 + n_2 + (r_1 + r_2) + 3 - d$; curves and properties of osmotic systems are discussed on this basis. Also in *Proc. Acad. Sci. Amsterdam* 28, 243-51(1925). VIII. *Ibid* 369-76.—It is derived from the thermodynamic potential function, that the above mentioned phase rule also holds for a system with a "real" membrane, i. e., a new phase permeable only for some of the components.

B. J. C. VAN DER HOEVEN

Equilibria in systems in which phases are separated by semipermeable membranes. IX. Two three-component systems. F. A. H. SCHREINEMAKERS. *Verslag Akad. Wetenschappen Amsterdam* 34, 446-55(1925); cf. preceding abstr.—Mathematical derivation of the equil. conditions between 2 systems sepd. by a semipermeable membrane, which have 1, 2 or 3 components in common. GEORGE CALINGAERT

The system sodium sulfite-sodium hydroxide-water. D. L. HAMMECK AND J. A. CURRIE. *J. Chem. Soc.* 127, 1623-8(1925).—The nature of the solid phases in equil. with solns. contg. Na_2SO_3 and NaOH was detd. at 0.15, 20, 25 and 32°. Analyses of the liquid phase were accurate to $\pm 0.5\%$. The concn. range of NaOH soln. was from 0 to 54% by wt. The results at 0.15 and 32° are shown on Schreine-

maker's triangular diagrams. At 32° $\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$ cannot exist in contact with any aq. soln., confirming Lewis and Rivett's detn. of the transition point at 31.5° (cf. *C. A.* **18**, 1605).

R. L. D.

Higher oxides of silver. II. Silver peroxide. Analysis and the heat of formation. F. JIRSA, with exptl. assistance of J. JELINEK and J. ŠRECK. *Chem. Listy* **19**, 114-20, 191-5 (1925), cf. *C. A.* **19**, 2460. — *Analysis.* If Ag_2O_2 is dissolved by a nonoxidizable acid such as H_2SO_4 or HClO_4 , all the active O is liberated as O_2 , e. g., $2\text{Ag}_2\text{O}_2 + 2\text{H}_2\text{SO}_4 = \text{O}_2 + 2\text{Ag}_2\text{SO}_4 + 2\text{H}_2\text{O}$, and may then be measured in a gas buret. Decompos. with NH_4OH proceeds with liberation of N_2 , but not stoichiometrically. Total O can be detd. by reduction of the compd. with $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$, according to the equation $\text{Ag}_2\text{O}_2 + \text{N}_2\text{H}_4 \cdot \text{H}_2\text{O} = \text{N}_2 + 2\text{Ag} + 3\text{H}_2\text{O}$, so that either the N_2 can be measured or the analysis can be done by direct titration. The Ag is best detd. by ignition and weighing. The active O can also be detd. titrimetrically by dissolving the Ag_2O_2 in a concd. soln. of KI (1 g. KI in 3 cc. H_2O) dilg. and titrating the liberated I_2 with $\text{Na}_2\text{S}_2\text{O}_3$. — *Calorimetric measurements.* — The reactions of Ag_2O_2 with HClO_4 or $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$ are perfectly definite, and hence are suitable for the measurement of the heat of formation of the compd. From (1) $\text{Ag}_2\text{O}_2 + 2\text{HClO}_4 = 2\text{AgClO}_4 + \text{H}_2\text{O} + \text{O}_2$, Δ_1 cal. and (2) $\text{Ag}_2\text{O}_2 + 2\text{HClO}_4 = 2\text{AgClO}_4 + \text{H}_2\text{O}$, Δ_2 cal., one gets by subtraction $\text{Ag}_2\text{O}_2 = \text{Ag}_2\text{O} + \frac{1}{2}\text{O}_2 + (\Delta_1 - \Delta_2)$ cal. However, both Δ_1 and Δ_2 vary with concn. of the acid, and since the rate of dissolution of Ag_2O_2 in dil. HClO_4 is very slow, it was found necessary to measure Δ_1 and Δ_2 at several high concns. of HClO_4 , and then extrapolate the difference to zero concn. By such extrapolation $(\Delta_1 - \Delta_2)_0 = 1000$ cal. very nearly. Then, taking the value of Lewis for $(\text{Ag}_2\text{O}) = 6440$ cal., one obtains for the heat of formation of Ag_2O_2 5440 cal. Value of $(\Delta_1)_0$ was calcd. from the known heats of formation of Ag_2O , HClO_4 , H_2O , and a measurement of the heat of formation of AgClO_4 , the equation used for the measurement of the latter being $\text{AgClO}_4 + \text{HHal} = \text{AgHal} + \text{HClO}_4 + z$ cal., for z the following values were obtained: 17,084 cal. in 1 N HCl, 15,754 cal. in 0.1 N HCl, 20,518 cal. in 0.1 N HBr, and 26,871 cal. in 0.05 N HI. The following values were taken from the literature: (H, Cl, O) = 38,600 cal. (Berthelot), (H, Cl) = 39,355 cal., (Ag, Cl) = 29,190 cal., (H, Br) = 28,190 cal., (Ag, Br) = 23,050 cal., (H, I) = 13,185 cal., (Ag, I) = 14,000 cal., (H_2 , O) = 68,360 cal. (L. B. Table). Applying Hess's law, (Ag, Cl, O) = 12,681 cal. in 0.1 N HCl, 12,681 cal. in 0.1 N HBr and 12,514 cal. in 0.05 N HI, the av. being given as 12,622 cal. Using this value, $(\Delta_1)_0 = 9264$ cal., and $(\Delta_1)_0 = 10,964$ cal. as the *heats of soln. of Ag_2O and Ag_2O_2 , resp., in infinitely dil. HClO_4* . The procedure used in detn. of the heat of formation of Ag_2O_2 from the heat effect due to its reaction with $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$ was analogous to that used with HClO_4 . The equations used are (1) $\text{Ag}_2\text{O}_2 + \text{N}_2\text{H}_4 = 2\text{Ag} + \text{N}_2 + 2\text{H}_2\text{O} + y_1$ cal., (2) $2\text{Ag}_2\text{O} + \text{N}_2\text{H}_4 = 4\text{Ag} + \text{N}_2 + 2\text{H}_2\text{O} + y_2$ cal., and $\text{Ag}_2\text{O} = 2\text{Ag} + (\Delta_1 - y_2)$ cal., expts. yielding $y_1 = 146,276, 135,430$ and $131,880$ cal. in 2.5, 0.62 and 0.33% solns. of $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$, $y_2 = 133,319$ and $126,756$ cal. in 2.5 and 0.50% solns., resp. The author's extrapolation yields $(y_1 - y_2)_0 = 7500$ cal. This value combined with the value previously used for (Ag_2O) gives $(\text{Ag}_2\text{O}_2) = 5280$ cal., agreeing well with the figure derived from the acid reaction, but it should be pointed out that this agreement is based on a somewhat questionable extrapolation for $(y_1 - y_2)_0$. For the same reason a value of $(\text{Ag}_2\text{O}_2) = 5440$ cal. obt'd. by the author in a third set of expts., in which HNO_3 was used as solvent, loses some of its weight. The procedure in this case was analogous to that used with HClO_4 . Ag_2O_2 reacts with HNO_3 somewhat abnormally, yielding brown solns. which decolorize rather slowly.

F. C. KACER

Dissociation of some metal oxides. FRITZ BORN. *Z. Elektrochem.* **31**, 309-11 (1925). — On the basis of Nernst's heat theorem, existing data being used as far as possible and the rest estd., the degree of dissociation of gaseous oxide at 2000° and at 3000° (both for 1 and for 10^{-3} atm.), the partial pressures of the gas at these temps. and the degree of dissociation of the solid oxide have been calcd. and tabulated. (Al_2O_3 , CaO , Cr_2O_3 , MgO , SiO_2 , ThO_2 , TiO_2 , WO_3 , ZrO_2 .) An extensive bibliography of thermal data is given.

B. J. C. VAN DER HORVEN

The thermal decompositions of metallic sulfates. GERMAINE MARCHAL. *I. chim. phys.* **22**, 325-48 (1925). — Preliminary paper. M. proposes to det. the dissociation curves for the sulfates of Mg, Be, Ni, Co, Mn, Cd, Ag, Ga and the double sulfates of K-Be and K-Mg and to study the effect of SiO_2 , Al_2O_3 and Fe_2O_3 on the dissociation of CaSO_4 . The heats of dissociation of all sulfates listed above except those of Ga, Be and K-Be are calcd. from existing data. The heats of formation of BeSO_4 (273,280 cal.; 272,900 cal. by 2 cycles of reactions) and of $\text{BeSO}_4 \cdot \text{K}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ (14,700 cal.) have been detd. From these values the heats of dissociation have been calcd. $\text{BeSO}_4 \rightarrow \text{BeO} + \text{SO}_3 - 49,800$ cal.; $\text{K}_2\text{SO}_4 \cdot \text{BeSO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{BeO} + \text{SO}_3 - 58,500$ cal.

The calorimetric measurements were made with a Pt calorimeter, a Hg thermometer which was read to 0.001° being used. Bibliography. E. R. SCHIER

Application of X-ray diffraction to the determination of the transformation temperature of thallium. G. ASAHARA. *Sci. Papers Inst. Phys. Chem. Res. (Japan)* 2, 125-37(1924).—The X-ray diffraction pattern from rolled Tl undergoes a sharp change at the transition temp. of α' Tl to β Tl. By slowly heating or cooling a sample of Tl through the critical temp., and recording the X-ray diffraction pattern on a series of photographic films, exposed at various time-intervals during the process, it is possible to obtain a measurement of the transformation temp. which was found to be 231.3°, in fair agreement with results of other experimenters. S. K. ALLISON

Trouton's rule as a criterion for association. CARL WAGNER. *Z. Elektrochem.* 31, 303-9(1925).—It is shown from Nernst's vapor pressure formula that for a liquid practically consisting of double mols. with a single mol. vapor, the Trouton quotient λ/T_b (λ = heat of vaporization in cal per mol.; T_b in abs. degrees) becomes 28.1 (the normal value is 22). B. J. C. VAN DER HOEVEN

Determination of the conditions of dissociation from the heat of formation. D. K. ZAVRIAN. *J. Russ. Phys. Chem. Soc.* 54, 805-13(1924).—A chem. reaction gives a different value for energy change depending on whether the reaction proceeds reversibly or irreversibly, while phys. and mech. processes give the same value regardless of their reversibility. Thermodynamics gives the correct soln. A special case of the equation $A - U = -TS$ is taken when $A = 0$; hence $U = TS$. Then the Helmholtz equation $A - U = TdA/dT$ becomes the Clapeyron equation if the work of expansion is substituted for the undetd. work A . On introducing into this the ideal gas laws the van't Hoff-Le Chatelier equation is obtained, $d \ln p = UdT/RT^2$. Integrating: $R \ln p = -(U/T) + C$. This const. of integration is equal to the entropy S when $p = 1$ atm. As a first approx. entropy can be solved from $S_1 = U/T_1 = 17 + 0.0157$, (Le Chatelier "Recherches," 1887). From these equations it is possible to figure the temp. when the pressure of dissocn. is given or the pressure when the temp. is given. Several examples are given to illustrate the applicability of these equations. A. C. ZACHLIN

The temperature distribution in free reflecting glowing iron blocks. HANS SCHMICK. *Z. tech. Physik* 6, 365-70(1925); 9 cuts.—The temp. distribution in cylindrical Fe blocks has been calcd. for the first minutes after the beginning of cooling and for an initial temp. of 1200°. The temp. of the surface so ascertained is connected with the mean temp. of the block. The difference between these temps. is considerable with blocks of large diam., since the cooling progresses only very slowly towards the interior of the block. The expts. herein reported on Fe rods of 3 cm. diam. are of the order of magnitude of those calcd. J. H. PERRY

The heat produced in the formation of "chloride of lime." BERNHARD NEUMANN AND GEORG MÜLLER. *Z. angew. Chem.* 38, 193-5(1925).—Cl was passed over damp Ca(OH)_2 in a vacuum-walled calorimeter. The temp. of in- and out-going Cl was measured and that of the calorimeter by a Beckmann thermometer. Satisfactory results were obtained only with specially pure Ca(OH)_2 . The phys. condition of the Ca(OH)_2 influenced the results. Differences of over 1% between 2 series of expts. using different quantities and times were attributed to the Ca(OH)_2 . Exptl. error was less than 0.2%. The chlorination was, resp., 41.5 and 40.1%. 100.1 cal. per g. of Ca(OCl)_2 was taken as the best value. This corresponded to 237-247 cal. per g. of Cl. The chlorination was a max. with 4% excess of H_2O . Carefully dried Ca(OH)_2 and Cl gave no reaction. W. P. WHITE

The heat produced in the formation of chloride of lime. O. NYDEGGER. *Z. angew.-Chem.* 38, 549(1925); B. NEUMANN AND G. MÜLLER, *Ibid* 550; cf. preceding abstract.—Nydegger in 1920 had found 265 cal. per g. of Cl in expts. similar to those of Neumann and Müller. He thinks their different results were due to extra reactions. In reply, they point out that Nydegger's whole procedure was full of sources of possible error, and rests on only 3 detns. of which he takes only one as correct. The other 2 gave results nearer those of Neumann and Müller. Hence his result is probably incorrect. W. P. WHITE

Heat of formation of formaldehyde. H. VON WARFENBERG AND LERNER-STEINBERG. *Z. angew. Chem.* 38, 591-2(1925).—Recent detns. of Michlinski (*C. A.* 19, 769) gave the surprisingly high value of 158.8 cal. per mol. for the combustion heat. His work has been repeated and although no apparent mistakes could be detected the heat of combustion for: $\text{CH}_2\text{O(gas)} + \text{O}_2 = \text{H}_2\text{O(liq.)} + \text{CO}_2$, has now been found to be 134.1 cal. 3202 at const. vol. with a probable error of less than 1%. For the heat of formation from $\text{CO} + \text{H}_2 + 1.4$ cal. is obtained. B. J. C. VAN DER HOEVEN

The heats of oxidation of carbon monoxide and of hydrogen by manganese dioxide

at 0°. J. C. W. FRAZER AND C. E. GREIDER. *J. Phys. Chem.* **29**, 1099–1104 (1925).—When CO is lead over an active MnO_2 catalyst even at 0° the CO is rapidly oxidized but equiv. amts. of CO_2 are not formed, some being retained as MnCO_3 . The measured heats of adsorption are consistent with the hypothesis that the 2 reactions occurring are $2\text{CO} + 3\text{MnO}_2 = \text{Mn}_2\text{O}_3 + 2\text{CO}_2$ and $\text{CO} + \text{MnO}_2 = \text{MnCO}_3$. The catalyst will also slowly adsorb H_2 even at 0°. F. R. B.

• Temperatures corresponding to equally diminished densities. W. HERZ. *Z. anorg. allgem. Chem.* **44**, 40–4 (1925).—In testing the laws of corresponding states, like temps. or pressures are commonly used. H. investigates for 39 or more substances (elementary gases and compds and org. fluids) the temps. necessary to reduce the d. to $1/2$ or more of the crit. for the gases, and to 2 or more times the crit. for the liquids. These temps. are calcd. as fractions of the crit. temp. For gaseous ds. of $1/2$, the temps. are at worst only 1% from 0.978 of the crit. temp. For $1/10$ d. the temp. is 0.830 of the crit. temp. to within 5 or 6%. The $1/60$ th d. is also treated, with extreme fluctuation of 7.5 or 11.5%. The av. temp. for double d. with liquids is 0.890 times the crit. temp., to within 6%; 0.009 to 7 or 9% for 2.75-fold d. W. P. WHITE

• Basis for the calibration of the optical temperature scale. F. HENNING AND W. HEUSE. *Z. Physik* **32**, 799–822 (1925).—Data and theory are given for the calibration of the usual types of optical pyrometers. F. R. B.

• Researches on metal crystals. III. Thermal expansion of zinc and cadmium. E. GRÜNEISEN AND E. GOENS. *Z. Physik* **29**, 141–56 (1924); *Science Abstracts* **28A**, 273–3; cf. *C. A.* **18**, 3505.—By using the monocryst. rods previously described the coeffs. of expansion parallel and perpendicular to the cryst. axis were detd. for a range of temp. from -253° to $+100^\circ$. The dependence upon temp. is very marked, and quite different for the 2 directions; the coeff. perpendicular to the axis becomes negative at low temps. A theoretical investigation of the dependence of the coeffs. upon temp. is given, which is in very fair agreement with the observations, including the negative coeff. H. G.

• Thermal method for the study of gaseous systems. G. PICCARDI. *Atti accad. Lincei [vi]* **1**, 226–9 (1925).—The results of expts. on dry air and on N_2O_4 show that the method previously described (*C. A.* **19**, 757) gives at least qual. indications of the changes in the gas which are produced by a rise of temp. B. C. A.

• Thermochemical investigations on the constitution of acids in solution. D. D. KARVÉ. *Quart. J. Indian Chem. Soc.* **1**, 247–62 (1925).—Discussing Hantzsch's theory of true and pseudo acids, K. emphasizes the value of detn. of the heats of soln. of the acids in various solvents. While the heat of soln. cannot decide what compds are formed between the acid and solvent, it serves to give an idea about the affinity between them, and about the stability of the compds. formed. The heats of soln. of H_2SO_4 , HCl , HBr , HI , HCOOH and CH_3COOH in H_2O and various org. solvents are given in tabular form. F. C. KRACEK

• The specific heat of air. K. NESSELMANN. *Z. tech. Physik* **5**, 151–3 (1925).—The sp. heat of air in the region from -79.3 to 250° and up to 200 atm. pressure is satisfactorily represented as a function of $vT^{1/2}+1$ and $(v-b)/v = \beta$ by the equation: $C_p = C_p^0 + [(4.76\beta - 2.84)/(vT^{1/2} - 4.34)]$, where C_p^0 is the const. pressure sp. heat at zero pressure and b is van der Waals' const. J. H. PERRY

• Knowledge of specific heats. STEGBERT WIESNER. *Ann. Physik* **76**, 439–43 (1925). Correction. *Ibid.* **76**, 802.—Theoretical, dealing with the change from solid to liquid. W. P. WHITE

• Apparent heat of solution of entriotropic modifications at their transition points. ERNST COHEN AND H. L. BREDGE. *Verslag. Akad. Wetenschappen Amsterdam* **34**, 377–90; *Z. physik. Chem.* **117**, 143–55 (1925).—Recently Mondain Monval (*C. A.* **19**, 1978) has given an exptl. verification of Le Chatelier's tangent law $(dc/dT)_1/(dc/dT)_2 = Q_1/Q_2$ for the two (III and IV) modifications of ammonium nitrate. C. and B. show that owing to a lack of precision in M.'s method his results are hardly conclusive; a recalcn. yielded 1.10 and 1.16 for the two ratios, 31.8° for the transition temp. Repeating work of Cohen and others (*C. A.* **19**, 2160) the d.-concn. curve for NH_4NO_3 was again detd. between 0° and 32° : $(v_e)_{32.3^\circ} = 1.00529 - 0.00392915c + 0.049640c^2 - 0.0333c^3$ for modification IV; this gives a $c-t$ equation. $c_{IV} = 54.241 + 0.6106t - 0.00297t^2$. The d. curve of modification III detd. between 33° and 48° is given by $(v_e)_{50.0^\circ} = 1.01227 - 0.0038565c + 0.03855c^2 - 0.0319c^3$; from it $c_{III} = 57.861 - 0.4384t - 0.00111t^2$. It follows that the transition temp. is 32.27° with $c_{III} = c_{IV} = 70.85$ (all concn. expressed in g. salt per 100 g. solu.). The tangent ratio equals 1.14, the ratio of the solution heats as previously detd. 1.15, a more satisfactory agreement. B. J. C. VAN DER HORVEN

The thermodynamics of the solutions of some simple electrolytes. H. S. HARNED. *Z. physik. Chem.* 117, 1-50(1925).—The e. m. fs. of the following cells are measured: $\text{H}_2 | \text{NaOH}(c_2) | \text{Na}_2\text{Hg} | \text{NaOH}(c_1) | \text{H}_2$; $\text{H}_2 | \text{NaOH}(c_1), \text{NaCl}(c) | \text{Na}_2\text{Hg} | \text{NaOH}(c_2) | \text{H}_2$; $\text{H}_2 | \text{KOH}(c_1), \text{KCl}(c) | \text{K}_2\text{Hg} | \text{KOH}(c_2) | \text{H}_2$. From these and other measurements are calcd. the activity coeff., the product of the activity coeff. and the dissociation of water in solns. of NaCl and KCl. At increasing salt concns. the dissociation at first decreases but finally increases. The properties of the single ions seem to be in agreement with the Debye Hückel equation. Details on the manipulation of amalgam cells are given. F. R. B.

The third law of thermodynamics and calculation of entropies. T. J. WEBB. *J. Phys. Chem.* 29, 816-33(1925).—The heat of soln. of a mixt. of I_2 and Ag in concd. K_2 is 17.22 kcal./mol., of AgI 2.28 kcal., of the same substances in concd. NaI soln. 16.80 and 1.78 kcal., resp., in concd. KCN soln. 27.48 and 12.28 kcal., resp. The heat of soln. of Br_2 (liquid) in a suspension of Ag in concd. NH_4Br soln. is 23.81 kcal./mol. The heat of soln. of AgBr in the same solvent is 0.0. From these data the heats of formation of AgI and AgBr are calcd. to be 14.97 ± 0.05 and 23.81 ± 0.05 kcal./mol. resp. From these and other data the entropy of CdCl_2 (in $\text{CdCl}_2 \cdot 2.5\text{H}_2\text{O}$) is calcd. to be 47.6, 47.0 and 47.2; that of CdI_2 39.1, 38.5, 38.6; that of H_2 13.95, 14.24, 14.05, ± 0.5 cal./degree. F. R. BICHOWSKY

The movement of flame in closed vessels. O. C. DE C. ELLIS AND R. V. WHEELER. *J. Chem. Soc.* 127, 764-7; *Fuel in Science & Practice* 4, 356-61(1925).—By means of the app. described by Ellis and Robinson (*C. A.* 19, 2747), photographs of moving flames were taken at intervals of 0.00458 secs., which show that the flame propagates in regular concentric spheres. That the rate of propagation is affected by cooling due to the walls is shown by the fact that the pressure attained at any time is smaller if the point of ignition is at the bottom instead of at the center of the vessel. G. CALINGAERT

Thermodynamic potential differences at the boundary of two liquid phases. I. SERG. WOSNESSENSKY. *Z. physik. Chem.* 115, 405-23(1925).—It is known that the distribution of an electrolyte between 2 liquid phases takes place in accord with the formula $C_1/C_2^n = K$ where $n = 1$ only in special cases. It is also known how to calc. the potentials of concn. and chem. cells composed of links each of which contains an electrolyte distributed between 2 different solvents. The e. m. f. of concn. cells, contg. one electrolyte distributed between 2 solvents, will in general be zero, if $n = 1$, regardless of the concn. differences between the 2 halves of the cells. Similarly, the e. m. f. of chem. cells, contg. 2 different electrolytes in the same pair of solvents in the 2 halves of a cell, will be const., if $n = 1$, and the 2 electrolytes do not exert any mutual influence on the distribution relations. W. presents a considerable amt. of exptl. material which confirms these conclusions. F. C. KRACEK

Connection between thermoelectric power and space lattice for pure iron. A. GOERTZ. *Physik. Z.* 26, 260-4(1925); cf. *C. A.* 19, 771.—The change from β - to γ -iron at the A3 point is accompanied by a change from the space-centered cubic lattice to the surface-centered cube, together with a great decrease in dE/dT (Richardson equation). This ratio increases in the γ to δ transformation. The space-centered lattice is thermoelectrically positive with respect to the other form. E is proportional to the capacity of the negative component for absorbing electrons, which itself depends on the crystal structure. In spite of its greater density, γ -iron has a smaller capacity for holding electrons than the β -modification. G. considers the thermoelec. processes to be governed by the at. force-fields. Each atom has its own sphere of force and between atoms there is a free space, where these are small. The free space det. the power of retaining electrons and the thermoelec. properties. It is assumed that the radius of the force-field is half the smallest distance between atoms in the lattice. This leads to the conclusion that this distance does not change at the transformation point. The assumption is justified within the limits of error by expt. on the thermoelec. power near the transformation point. Moreover, the behavior of Fe under dilatation and compression, together with the trifling change in the temp.-resistance curve at this point, can all be harmonized with the conception. The Fe crystal lattice which is capable (in the thermoelec. sense) of retaining most electrons, possesses (in the sense of the Richardson equation) the largest no. of free electrons. B. C. A.

Cooling of hot bodies in gases and liquids. R. SEELIGER. *Physik. Z.* 26, 282-95(1925).—A review and bibliography of the hydrodynamic and gas film theories of cooling. B. C. A.

Electronic theory of the anodic behavior of metals, especially those exhibiting passivity phenomena. U. Sborgi. *Atti accad. Lincei [vi]* 1, 315-8(1925).—On the basis of the most recent views concerning the distribution of the electrons in the atoms of

different elements (cf. Lewis, "Valence and the Structure of Atoms and Molecules," cf. *C. A.* 18, 499, and Bohr, "Les spectres et la structure de l'atome"), S. shows that each large period of the periodic system may be divided into 3 portions: (1) Elements preceding the transition elements. The configuration of the kernel is that of the initial noble gas, the kernel and valency are fixed, and the ionization is of the metallic type, taking place with simultaneous loss of all the valency electrons. (2) Transition elements, with which the kernel and valency are variable, and the ionization is usually metallic. (3) Elements subsequent to transition elements: pre-metalloids and metalloids. These have fixed kernels with the configuration of that of the final noble gas. The valency is fixed in the elements of the first kind (Zn, Cd), but variable in the remainder, for which also the ionization is metalloid in type, taking place by partial loss of the valency electrons. The constancy of the valency of Zn and Cd may be a particular case of the phenomenon that the alteration of valency for all elements of this category usually occurs in double steps, so that for bivalent elements the only ordinary ionization possible is total ionization and these elements are thus of fixed valency. II. *Ibid* 388-92.—A nelectronic interpretation is suggested for various anode phenomena.

B. C. A.

• • Potentials of alkali metals from the decomposition potentials of fused alkali halides. BERNHARD NEUMANN and HELMUT RICHTER. *Z. Elektrochem.* 31, 287-96(1925).—Previous work was continued (*C. A.* 9, 3032). Decompn. potentials were detd. from breaks in the current-potential curve for KCl-NaCl, KI-RbI, KI-CsI, LiCl, LiBr, RbCl, RbBr, CsCl. E_y using for the anions Nernst values $e_{Cl} = 1.353$ v.; $e_{Br} = 0.993$ v.; $e_I = 0.52$ v. the following potentials were obtained as the best averages, including former detns., extrapolated to 18°. $e_{Cs} = 2.909$ v.; $e_{Rb} = 2.744$ v.; $e_K = 2.614$ v.; $e_{Na} = 2.454$ v.; $e_{Li} = 2.091$ v. The temp. coeff. of the decompn. potentials is almost the same for all the alkali halides (av. $-1.501 \cdot 10^{-3}$ v./degree) except for the Li salts which have $-1.347 \cdot 10^{-3}$. The results are tabulated and given in diagrams.

B. J. C. VAN DER HOEVEN

• Potentials of alkaline and rare earth metals from the decomposition potential of their halides. BERNHARD NEUMANN and HELMUT RICHTER. *Z. Elektrochem.* 31, 296-304(1925).—Measurements on fused BeCl₂, MgCl₂, CaCl₂, SrCl₂ and BaCl₂ yielded the following extrapolated potentials at 18°: $e_{Be} = 0.811 \pm 0.003$ v., $e_{Mg} = 1.422 \pm 0.001$ v.; $e_{Ca} = 1.903 \pm 0.002$ v.; $e_{Sr} = 2.075 \pm 0.002$ v.; $e_{Ba} = 2.15 \pm 0.005$ v. The temp. coeff. of the chloride decompn. potential is -0.714×10^{-3} ; for BeCl₂ $-0.965 \cdot 10^{-3}$. It follows from these values that above 800° some alk. earths are more positive than the alkali metals. For the rare earths and Al was found from values of fused ThCl₃, CeCl₃, LaCl₃, NdCl₃, PrCl₃ and AlCl₃·2NaCl $e_{Ce} = 2.097 \pm 0$ v.; $e_{Th} = 1.747 \pm 0$ v.; $e_{La} = 1.748 \pm 0.002$ v.; $e_{Nd} = 1.645 \pm 0$ v.; $e_{Pr} = 1.436 \pm 0.002$ v.; $e_{Al} = 0.645 \pm 0.006$ v. For the first 5 salts the temp. coeff. is around $-1.87 \cdot 10^{-3}$; for Al it is $-1.132 \cdot 10^{-3}$.

B. J. C. VAN DER HOEVEN

• Chemico-physical investigations on the catholyte of diaphragm electrolyzers with circulation of the sodium chloride. F. GIORDANI. *Rend. accad. sci. fis. mat. Napoli* [iii] 30, 150-65(1924).—The results are given of detns. at various temps. of d., viscosity, and cond. measurements of (1) NaCl solns. of concns. ranging from N to satn., (2) NaOH solns. ranging from 1.7 to 6.72 N , and (3) solns. contg. both the chloride and the hydroxide in proportions varying in accordance with the decompn. occurring in an electrolytic cell supplied with satd. NaCl soln. Contrary to theoretical anticipation, the equiv. conductivities of NaOH solns., corrected for the viscosity, increase with the concn. of the soln.; this result suggests considerable hydration of the ions, the degree of which diminishes as the concn. is augmented. The exptl. values of the cond. of the solns. contg. both chloride and hydroxide are in good agreement with those calcd. from the values for the sep. components. The accord is less satisfactory when the values of the cond. corrected for the viscosity are compared; this is due partly to the anomalous behavior of the hydroxide referred to above. In general, the results furnish abundant indication of the great influence of the viscosity of the ions and confirm the observation that the low mobility of the hydroxyl ions in the cathode liquids, in comparison with the value calcd. for infinite diln., is largely responsible for the high current yields given by circulating electrolyzers with diaphragms.

B. C. A.

• Behavior of diaphragm electrolyzers with circulation of the alkali chloride. IV. F. GIORDANI. *Rend. accad. sci. fis. mat. Napoli* [iii] 30, 135-49(1924).—For the current yield of circulating diaphragm electrolyzers in its dependence on the alkali concn. of the cathodic effluent, G. (*Ibid* [iii] 28, 142(1922)), derives the expression, $R = 1 - n / [1 + (x_1/x_2)] + 0.0103x_{1.2} / (U_{OH^-} + U_M) [1 + (x_1/x_2)] C_2$, where n indicates the transport no. of the cation of the alkali, x_1 and x_2 the resp. partial conductivities of the chloride

and alkali in the catholyte, $\chi_{1,2}$ the total cond. of the catholyte, U_{OH} and U_M the resp. effective velocities of the hydroxyl and metal ions per 1 v. of potential gradient, and C_2 the concn. of the alkali in the catholyte. Results obtained with electrolyzers fed with NaCl are now given, and correspond qualitatively, but not quantitatively, with the above formula; this is doubtless attributable to the uncertainty attending the detn. of the ratio χ_1/χ_2 . V. *Ibid* 181-8.—From data obtained for catholytes from an electrolyzer fed with satd. NaCl soln. G. calcs. the values of the velocity of the hydroxyl ion in the catholyte and of the total linear velocity with which the liquid is displaced normally to the diaphragm. The results show that, in counter-current electrolyzers, no loss in yield should be incurred on account of migration of the ions, the losses being due solely to diffusion phenomena; the reason for the great influence of the type of diaphragm on the yield is thus evident. Expts. made with small glass electrolyzers contg. asbestos diaphragms, the anode being of Acheson graphite and the cathode of iron gauze, show that almost theoretical yields are obtainable, even when the mol. concn. of the NaOH is comparatively high. B. C. A.

The solvation of ions and the electrode potential. J. HEYROVSKÝ. • *Rec. trav. chim.* 44, 447-50 (1925).—In Nernst's formula for electrode potentials a term is wanting which will express the work gained by letting the ions coming out of the metal solvate before bringing them into the soln. The new formula for a univalent metal is $\pi_{Me} = -(RT/F)\log(P/[Me]) - II_r/F$, where $[Me]$ is the concn. of the solvated ions in the soln. and $-II_r$ the free energy involved in the solvation of the ion in the vapor of the soln. having a vapor tension of τ . E. J. WITZEMANN

Abnormal ionic activities in concentrated alcoholate solutions. Z. KOUPČÍKOVÁ AND M. SHIKATA. *Rec. trav. chim.* 44, 451-8 (1925) cf. preceding abstract.—In the precise formula of Heyrovský for the electrode potential $\pi = -[(RT/F)\log(P/[Me])] + [m.M.RT.c/\delta 1000.F] + \text{const.}$, the 2nd term is negligible in dil. solns. but in 1.0 N aq. solns. its value is some millivolts. This increase of the positiveness of the electrode is due to the solvation of ions and will be larger the greater the mol. wt., M , of the solvent. S. (C. A. 18, 631) has observed that in NaOEt concn. cells with 1.0 N solns. the e. m. f. increases abnormally; this increase was ascribed to increase in activity of Na ions caused by the diminution of their solvation in very concd. solns. When compared with the activity increases of alkali ions in most concd. aq. solns. the increase appears 2 or 3 times as large. In this paper additional results are given. The abnormal ionic activity increase, which is known to occur in concd. aq. and ethoxide alc. soln., was confirmed by measuring the e. m. f. of concn. cells with K-Hg electrodes in KOEt solns. in EtOH. Measurements with similar concn. cells contg. Na and K alcoholates of isoamyl alc. reveal a still more pronounced abnormal ionic activity increase in most concd. solns., this being in agreement with II.'s formula for the effect of desolvation of ions upon the electrode potential. Conc'd. Na isoamyl alcoholates show a peculiar slow decrease of activity. E. J. WITZEMANN

The relation between the dielectric properties and the molecular associations of several liquids. LUISE LANGE. *Z. Physik* 33, 169-82 (1925).—The dielec. consts. of org. liquid mixts. as they depend upon concn. and temp. are measured by the Nernst method. The mixts. are nitrobenzene in C_6H_6 , in C_7H_8 , in CS_2 ; pyridine in C_6H_6 ; ether in C_6H_6 ; iso-BuOH in C_6H_6 ; AmOH in C_6H_6 ; iso-AmOH in C_6H_6 . The results are discussed in terms of the Debye dipole theory (cf. Marx, *Handbuch der Radiologie*, 1924, vol. 6) and mol. association. The mol. moments of the above solute liquids are, resp., 3.84, 2.11, 1.22, 1.53, 1.65, 1.72, 1.83 and 1.76×10^{-18} . GEORGE L. CLARK

Electrometric study of the effect of neutral salts upon the hydrogen electrode potential. V. A. ARKADIEV. *J. Russ. Phys. Chem. Soc., Physical Part*, 56, 96-106 (1924).—Using as an electrolyte 0.1 N HBr in the chain (Pt), $H_2 \parallel HBr$, 0.1 N + neutral salt [KCl 1.0 N, 1.75 N, 3.5 N] KCl, 1.0 N, HgCl \parallel Hg. A. studied the effect of the salts KCl, KNO₃, KBr, NaCl, LiCl and LiBr (in the order of their hydration tendency) upon the H_2 -electrode potential. The liquid potentials were eliminated by the method of N. Bjerrum. Whether the neutral salts decrease the soln. pressure of the H_2 as a result of its dehydration in their presence, or the dehydration process decreases the rate of ionization of the H_2 , the measurements indicate that the effect upon the electrode potential increases with the increasing tendency of the salts for hydration. Salts with anions like the electrolytes (KBr, LiBr), show a greater effect. The paper contains 6 tables with numerous data. J. L. SHERESHEFSKY

The potential between the 0.1 N and 3.5 N calomel electrodes. J. K. GJALDBAEK. *Kgl. Danske Videnskab. Selskab. Math. fys. Medd.* 5, No. 9, 17 pp. (1925).—The av. value of the p. d. between the 0.1 N and 3.5 N calomel electrodes at 18° is 83.13 milliv., and the temp. coeff. of the 3.5 N electrode is nearly 0.45 milliv. per degree between 18

and 25°. Materials of known origin were used throughout. The individual electrodes were const., but considerable differences were noted between different electrode.

F. C. KRACEK

Reduction of uranyl salts with a dropping mercury cathode. P. HERAS' MFNKO. *Chem. Listy* 19, 172-9 (1925).—The first reduction potential obtained in the electrolysis of UO_2SO_4 with the dropping Hg cathode corresponds to the change $\text{U}^{VI} \rightleftharpoons \text{U}^V$, the change of potential for tenfold diln. being on the av. -0.050 v., the same as for the electrodeposition of univalent ions. The mechanism of the reaction may be: $\text{UO}_2^{++} + 2\text{e}^- = \text{UO}_2$ followed by $\text{UO}_2 + \text{UO}_2^{++} = \text{U}_2\text{O}_4^{++}$. Quinquevalent U is known to exist in UCl_5 . Polarization curves show that U is not reduced to lower valencies until the cathodic polarization becomes much higher than that necessary for the first stage. They exhibit characteristic max. of intensity of the polarizing current accompanying regularly the first stage of reduction. Certain electrolytes minimize the formation of these maxima, probably facilitating the adsorption of the products of electrolysis at the cathode.

FRANK C. KRACEK

Making visible the high-frequency longitudinal vibrations of piezoelectric crystal rods. E. GIEBE AND A. SCHEIBE. *Z. Physik* 33, 335-44 (1925).—The fundamental and up to the 15th harmonic high-frequency elastic longitudinal vibrations of rods of quartz are visibly registered by a luminous elec. discharge in vacuum. The discharge potentials are detd. through the piezo effect following the deformation of the vibrating rod.

GEORGE L. CLARK

A method for the measurement of electrical anisotropy in a metal sheet rolled in one direction. R. BECKER AND F. BORN. *Z. tech. Physik* 6, 356-8 (1925).—A description of a quantum method for the comparison of the elec. cond. of anisotropic metal sheets in different directions. A study of W, rolled in 1 direction only, has been made. The difference in cond. at right angles and parallel to the direction of rolling is less than 5%.

J. H. PERRY

A simple method for the qualitative recognition of the piezo-electric effect in crystals. E. GIEBE AND A. SCHEIBE. *Z. Physik* 33, 760-6 (1925).—A mass of small piezoelec. crystals may be set into elastic vibration by electromagnetic waves. This vibration may be recognized as a resonance tone in a telephone. According to recognized theory all substances with polar axes should show the piezoelec. effect. Of the 32 substances supposed to belong to this class 27 showed the effect when tested by this method.

F. R. B.

Influence of a magnetic field on gas reactions. GERTRUD KORNFIELD. *Naturwissenschaften* 13, 744 (1924).—The reaction between the 2 paramagnetic gases NO and O_2 was slightly accelerated by the application of a magnetic field (pressure some mm. Hg), due to directional quantization of the mols. Expts. are being continued.

B. J. C. VAN DER HOEVEN

Paramagnetism of "odd molecules." N. W. TAYLOR AND G. N. LEWIS. *Proc. Nat. Acad. Sci.* 11, 456-7 (1925).—According to the magnetochemical theory of L. (C. A. 18, 3533), paired electrons in a mol. produce a diamagnetic effect, while the presence of an unpaired electron produces paramagnetism. This prediction has been confirmed by the recent work of Soné on NO and NO_2 . Further, T. and L.'s expts. on a dil. soln. of ClO_2 in CCl_4 indicate that ClO_2 is paramagnetic and that its molal susceptibility (1310×10^{-6}) does not differ from that of NO_2 by more than 5%. Considering the inherent errors of observation, this is taken to indicate that the molal susceptibility of all "odd mols." has the same value. Other expts. on Na dissolved in liquid NH_3 , and Te dissolved in Hg, confirmed the paramagnetism of "odd mols." but failed to give decisive evidence on the question of the constancy of the molal susceptibility.

W. W. S.

Remark on the magnetic data of the rare earths. STEFAN MEYER. *Physik. Z.* 26, 478-9 (1925).—Tests with exceptionally carefully prepd. samples of the rare earths indicate that the following are more accurate values than those previously given (C. A. 19, 1653) for the molal susceptibility (k) and the no. (n) of Weiss magneton, resp., Yb, $k = 9.3 \times 10^{-6}$, $n = 23$; Eu, $k = 4.2 \times 10^{-6}$, $n = 15.5$.

W. W. STIFLER

Artificial magnetic anisotropy of nickel. Phenomena of large discontinuities. P. FORRER. *Compt. rend.* 180, 1253-5 (1925).—Ni can be obtained in a state showing new magnetic properties. Barkhausen amplified the currents induced by progressive magnetization of a substance and found discontinuities. Van der Pol found 6500 discontinuities using a sample of Fe and 5000 with ferro-Ni. He further found that discontinuities could be observed with Ni even without amplification. This is confirmed for ordinary Ni wire, but if the same wire is drawn out the magnetization discontinuities disappear. If this drawn specimen is wound round a cylinder, the phenomenon reappears in an intensified form. The cycles have been studied by means of a magnetom-

eter under different field limits. With Ni stretched almost to breaking point, the cycle is wide and regular. When the same wire is wound round a cylinder, the results indicate sudden irregularities comparable in magnitude with the total magnetization. This sudden increase in magnetization occurs in spite of the gradual decrease in the field under the exptl. conditions. The property persists over long periods of time. Heating for a few seconds above 1000° causes the cycles observed to revert to those ordinarily found. Heating at 500° does not effect the reversion, while heating at temps. between 500° and 700° causes progressive diminution in the discontinuities. About 720° the cryst. lattice probably undergoes rearrangement. B. C. A.

On the characteristics of color pyrometry. HERMANN SCHMIDT. *Mitt. Kaiser-Wilhelm Inst. Eisenforschung, Düsseldorf* 6, 7-15(1925).—A general view. It is urged that instead of using such terms as "black-body temp." it is more logical and less confusing to specify the temp. of the radiation. Radiation of a given temp. is of course in equil. with a black body at that temp. It is suggested that the automatic registration of the radiation pyrometer can better be obtained by very sensitive thermopiles with monochromatic radiation, like an optical ("brightness") pyrometer. Color pyrometry, dealing exclusively with the ratio of the intensities of 2 (or more) wave lengths, is independent of the actual radiating power of the emitting surface, an advantage over brightness pyrometry. The precision of color pyrometry is ettd. at from 3° to 10°. The Arous chromoscope as well as the Helmholtz leucoscope can be used for color pyrometry. The pyroscope of Mesuré and Nouel is useless, showing discrepancies of 100° between different observers. W. P. WHITE

Relatively asymmetrical synthesis in the complex salts of heavy metals. J. LIFSCHITZ. *Proc. Acad. Sci. Amsterdam* 27, 721-5(1924) (in English); *Verslag Akad. Wetenschappen Amsterdam* 33, 661(1925).—An attempt to show the influence of mol. symmetry on the rotary dispersion of active colored compds. in which there is only a small variation in the symmetry of the mol. as a whole. Pure *d*-alanine boiled with Co(OH)₂ gives a red tri-*d*-alanine cobaltic salt, which is insol in H₂O. On fractional crystn. of the mother liquor, a violet salt contg. 1 mol. of H₂O is obtained in small needles. A more purple-colored and extremely sol salt is also obtained. The 2 latter compds. are considered as the partially asymmetrical antipodes: *d*-[Co-*d*-Alan₃] and *L*-[Co-*d*-Alan₃]. The rotary dispersion curves of these substances in H₂O and 50% H₂SO₄ are given. The differences in type of the curves for the first 2 compds. indicate that they are not merely geometrical stereoisomerides. ARTUR GROLLMAN

Method for the determination of the reflection coefficient of a metal as a function of the wave length and the temperature. W. J. BEEKMAN AND F. W. OUDT. *Z. Physik* 33, 831-5(1925).—The usual method for reflection coeffs. of metals is modified to allow correction for the thermal emission of the reflecting surface. The method is tried on Pt with satisfactory results as far as the change of the reflection coeff. with the wave length is concerned, but at temps. over 1300° the surface of Pt changes so fast that temp. coeffs. are not possible. F. R. R.

The scattering of light by liquid boundaries and its relation to surface tension. II. C. V. RAMAN AND L. A. RAMDAS. *Proc. Roy. Soc. (London)* 109A, 150-7(1925); cf. C. A. 19, 3059.—Expts. were made with 64 liquids. Surface scattering is most conveniently observed with liquids that show a small internal scattering, e. g., lighter paraffins, ether and alcohols. Other things being the same, a liquid having a higher surface tension shows a smaller surface opalescence and *vice versa*. Transparent liquids show an effect 30-50 times more intense than that observed with Hg. The variation in intensity and state of polarization of the scattered light with the angles of incidence and direction of observation shows some remarkable features. G. L. CLARK

Application of Ostwald chromometer to color development. J. MILBAUER AND J. LAUSCHMANN. *Chem. Listy* 19, 267-74(1925).—A description of the method in which O.'s chromometer may be used in evaluating the color values produced in the development of overexposed AgCl emulsion paper. F. C. KRACEK

Quantum theory of the ideal gas. A. EINSTEIN. *Sitz. preuss. Akad. Wiss.* 1925, 18-25; cf. C. A. 19, 928, 1528.—The statistical method employed by E. in the previous papers on the subject is based on a certain analogy between a light quantum and an atom, the two differing essentially in that the rest-mass of a light quantum is zero. The method is not entirely free from uncertainties, so a method for quantizing the ideal gas, avoiding arbitrary hypotheses, was sought. Using dimensional considerations, E. shows that the problem of the equation of condition of the ideal gas reduces to that of detg. 1 universal function contg. 1 unknown variable, if either 1 or the other of the 2 following hypotheses is permissible: (1) The entropy of a gas does not change in an infinitely slow adiabatic compression. (2) An ideal gas can exist in a stationary state

such that the distribution of velocities demanded by the dimensional considerations holds also in presence of an external, statistical, conservative field of force. The result of these considerations is twofold: first, a general condition which must be satisfied by every theory of the ideal gas is obtained, and second, it is shown that the condition equation derived by E. is disturbed neither by adiabatic compression nor by conservative fields of force. F. C. KRACEK

The composition of Wu-chu coinage, and an examination of ancient pewter. C. WANG. *Science (China)* 8, 839-54(1923).—Chinese bronze coins of 200 B. C. show an extremely low percentage of Sn, while Pb was prohibited by edict. Zn occurs in bronze from the 1st century B. C., but analyses and examn. of ancient records indicate that Zn was not recognized as a distinct metal till the 14th century A. D. W. H. ADOLPH

Electron in chemistry of solutions and in electrochemistry (PISSARZHEVSKII) 3. Apparatus to measure the coefficient of deviation from Boyle's law; and the determination of this coefficient for C_2H_2 (HOWARTH, BURT) 1.

Advancing the Science of Chemistry. Baltimore: The Johns Hopkins half-century committee. 36 pp.

ARLHJENIUS, SVANTE AUGUST: **Chemistry in Modern Life.** Translated from the Swedish and revised by Clifford S. Leonard. New York: D. Van Nostrand Co. 286 pp. \$3.00. Reviewed in *Ind. Eng. Chem.* 17, 1097(1925).

BRAGG, WM. HENRY: **The Crystalline State.** New York: Oxford University Press, American Branch. 31 pp. 70 cents. Reviewed in *J. Franklin Inst.* 200 403(1925).

CARBONELLI, GIOVANNI: **Sulle fonti storiche della chimica e dell'alchimia in Italia.** Rome: Istituto nazionale medico farmacologico. 210 pp.

LÖWE, FRITZ: **Fortschritte der Chem. Technologie in Einzeldarstellungen.** Vol. VI. **Optische Messungen des Chemikers und des Mediziners.** Edited by B. Rassow. Dresden und Leipzig: Theodor Steinkopff. 166 pp. Unbound M 6, bound M 7.20.

Ukrainskii Khemichnii Zhurnal. (Ukrainian Chemical Journal.) (New Journal). K. A. Krasuskii, editor. Vol. I. No. 1. Published by the All-Ukrainian Council of the Soc. of Friends of Chemical Defense and Industry of the Ukrainian Soc. Sov., Kharkov. 1925. 182 pp. Price 5 rubles a year. Reviewed in *J. Am. Chem. Soc.* 47, 2620(1925).

3—SUBATOMIC PHENOMENA AND RADIOCHEMISTRY

S. C. LIND

Formation of gold from mercury. ERICH TIEDE, ARTHUR SCHLEEDE AND FRIEDA GOLDSCHMIDT. *Naturwissenschaften* 13, 745-6(1925).—Hg distd. according to Miethe still had 0.3 mg. Au per kg. Hg. After 2 high-vacuum distns. no more Au could be detected. With this prepn. the expts. of Miethe were repeated in several forms, no resultant Au formation was observed in any case. B. J. C. VAN DER HOEVEN

Transmutation of mercury into gold. H. NAGAOKA. *Naturwissenschaften* 13, 682-4(1925); cf. *C. A.* 19, 1811.—High-tension sparks between a pure W point and Hg covered with paraffin oil yielded after some hrs. a viscous mass, from which, after vacuum purification, combustion with O and extn. with HCl, Au could be obtained, either in soln. with aqua regia or as ruby-red spots in the glassware (pictures given); occasionally microscopic Au films were found on the glass. The transmutation can only be accomplished in a concd. field of several million v. per cm. Detailed description and theory will be published in the *Japan J. Physics.* B. J. C. VAN DER HOEVEN

Gold from mercury. A. MIETHE. *Naturwissenschaften* 13, 635-7(1925); cf. *C. A.* 19, 1531.—A lecture. B. J. C. VAN DER HOEVEN

The atomic weight of gold prepared from mercury by Miethe and Stamaureich. O. HÖNIGSCHMID AND E. ZINTL. *Naturwissenschaften* 13, 644(1925).—By potentiometric titration of auric salt with $TiCl_3$ the at. wt. of Miethe's Au (cf. preceding abstract) was found to be 197.26 ± 0.2 by comparison with ordinary Au (197.2). The need for a mass-spectral analysis of this Au is emphasized. Also in *Z. anorg. allgem. Chem.* 147, 262-4(1925). B. J. C. VAN DER HOEVEN

• **Preparation of gold-free mercury.** E. H. RIESENFELD AND W. HAASE. *Naturwissenschaften* 13, 745(1925).—Technical Hg after distn. *in vacuo* between 60° and 100°, 0.1 mm. pressure 1.5 kg. per 24 hrs., contained 10^{-7} g Au per g.; after a second distn. 6.10^{-9} g. and after a 3rd modified distn. a less than detectable ($< 0.25.10^{-9}$ g.) quantity of Au.

Preliminary report on the disintegration of lead atoms. A. SMITS AND A. KARSEN. *Naturwissenschaften* 13, 699(1925).—It was found that very pure Pb used as electrode in a quartz vacuum arc did not show any change in spectrum after 10 hrs. burning with 10 amps., 100–120 v. potential. If run, however, on 30–35 amps., 80 v., after 6 hrs. traces of Hg lines appeared in the spectrum and after 10 hrs. the stronger Hg lines and Tl lines were all detectable, in the visible and in the ultra-violet part of the spectrum.

• **The resonance lines of neon.** G. HERTZ. *Z. Physik* 32, 933–9(1925).—See C. A. 19, 2452.

Multiplet structure. ARTHUR BRAMLEY. *Phil. Mag.* 50, 375–81(1925).

Certain postulates of the quantum theory. D. N. MALLIK. *Phil. Mag.* 50, 381–9(1925).

Note on a method of comparing inductance and capacity. T. B. VINYCOMB. *Phil. Mag.* 50, 439–44(1925).

A proposed model for the α -particle and some nuclear series. R. HARGREAVES. *Phil. Mag.* 50, 470–91(1925).

The Balmer law as an equation of motion. LEIGH PAGE. *Phys. Rev.* 25, 429–43(1925).—A mathematical attempt to provide an atom in which radiating electrons have a unifrequent motion.

The optical constants of solid cesium. J. B. NATHANSON. *Phys. Rev.* 25, 75–84(1925); cf. C. A. 19, 1809.

Molecular light dispersion in solid isotropic bodies. RICHARD GANS. *Ann. Physik* 77, 317–24(1925).—Mathematical paper.

The polarization of sodium D radiation excited by a parallel bundle of electrons. W. KOSSEL AND C. GERTHSEN. *Ann. Physik* 77, 273–86(1925).—Pure Na D radiation caused by a practically parallel ray of electrons did not show any polarization; no remembrance of the direction in which the excitation took place is present in the light radiated.

Absorption phenomena in photoelectrically conducting sodium chloride crystals. Z. GYULAI. *Z. Physik* 33, 251–60(1925).—The exptl. curve of selective optical absorption in photoelectrically conducting NaCl crystals is detd. after the crystals have been irradiated with light capable of producing the photoelectrons. As compared with the non-radiated crystal the absorption curve shows a lowering in max. and widening in the direction of longer wave lengths. The absorptions of radiated and non-radiated centers (the amicon formed in the yellow coloration of NaCl by X-rays) overlap, but they may be separately identified. Under optimum conditions about 60% of the centers may be excited. The action of light of long wave lengths depends upon quantized light absorption. An $h\nu$ of long-wave light yields in the positive primary photoelectric current a motion of electricity of the same magnitude as $h\nu$ of short wave length in the liberation of the negative primary stream.

Absorption of ultra-violet light by inorganic halides. F. H. GETMAN. *J. Phys. Chem.* 29, 853–64(1925).—Extinction coeff. in the ultra-violet region may be detd. with a high degree of accuracy by using a new sector photometer designed by Lewis (C. A. 13, 1549) in conjunction with a quartz spectrograph. Employing this instrument G. finds that CaCl_2 , SrCl_2 , MgCl_2 , ZnCl_2 and AlCl_3 in aq. soln. absorb light selectively, the λ corresponding to the head of the absorption band of each salt being approx. 2730 Å. U. This is in conformity with the results obtained by Brannigan and Macbeth (C. A. 11, 313) for HCl , NaCl , LiCl and RbCl . The mol. extinction coeff. increases with increasing at. wt. of the metallic constituent of the salt. Solns. of CaCl_2 do not follow Beer's law; it seems doubtful that this law applies strictly to any strongly polar compds. Certain metallic chlorides (Ba , Cd , Hg , Cu) do not exhibit selective absorption at the concns. examd., but they show marked general absorption. G. believes he has proved also that the persistence of the characteristic absorption band at 2730 Å. U. throughout the series of chlorides examd. cannot be attributed to the presence of the common ion, Cl^- .

The intensity of thallium absorption lines. W. KUHN. *Naturwissenschaften* 13, 724–6(1925).—Intensity detns. were made indirectly from the anomalous dispersion. Values of f (ratio of actual absorption to that of classical quasi-elastic electron) are

tabulated. The normal level was in all cases $2p_z$. It appears that both $2p$ and $3d$ have a main quantum no. 6, contrary to earlier data of Bohr. B. J. C. VAN DER H.

The influence of temperature on the absorption spectra of borax and phosphate beads. MARGUERITE FUNCK. *Z. wiss. Phot.* 23, 73-8(1924). H. R. MOORE

Magnetization of spectrum lines. Reminiscences and prospects. P. ZREMAN. *J. Franklin Inst.* 200, 305-11(1925).—A review. E. J. C.

The spectrum of halogens. W. GERLACH AND FR. GROHMANN. *Naturwissenschaften* 13, 608(1925).—The bands of the heated I spectrum previously measured (C. A. 18, 498) correspond to those recently found by Ludlam and West (C. A. 19, 2299) in the Cl and Br spectrum. The temp. influence on these bands is the same for all 3 elements.

The excitation of forbidden spectral lines. P. D. FOOTE, T. TAKAMINE AND R. L. CHENAULT. *Phys. Rev.* 26, 165-75(1925); cf. C. A. 19, 2451.—A discussion of violations of the Bohr selection principles. Forbidden lines for Hg, Cd and Zn are photographed.

The quantum theory of aperiodic processes. M. BORN AND P. JORDAN. *Z. Physik* 33, 479-505(1925).—The quantum and classical dynamics of a multiperiodic system which is disturbed by an aperiodic force are worked out in detail. The collision of an atom with an electron is such a case. For such cases the correspondence principle takes a special form. II. Remark on the integration of the perturbation equation. P. JORDAN. *Ibid* 506-8. F. R. BICHOWSKY

Regularities in the rare earth and titanium groups. G. V. HEVESY. *Z. anorg. allgem. Chem.* 147, 217-32(1925).—A quant. discussion is given of the properties of the rare earths on the basis of Bohr's theory. Yttrium (no. 39) has a group of 14 both more (La—Dy) and less (Ho—Lu) basic homologs; in the latter the decrease in attraction force for the valence electrons, due to the 5-quantum orbit, is compensated by an increase due to higher nuclear charge. Quadrivalent Ce ion is very similar to ions of the Ti group; it has lost a 4th electron, whereas neutral Ce is far different from Ti in properties. The above mentioned reason, increased quantum number of valence orbit and increased nucleus charge, balancing each other in the attraction force, also accounts for the great similarity of Zr and Hf; the increase in basicity from Zr to Hf (32 difference of at. no.) is a great deal less than that between Rb and Cs or Y and La (18 difference). As additional evidence for a diminishing attraction force due to higher nuclear charge, the mol. vol. was measured of the octahydrated sulfates of the rare earths; they decrease gradually from Pr(59) to Cp(71); differences less than expected occur between Sm and Eu, Yb and Cp, probably due to a completion of subgroups. Yttrium sulfate has a mol. vol. almost equal to that of europium sulfate. For d_{20} was found: Y 2.535; Pr 2.813; Nd 2.856; Sm 2.957; Eu 2.977; Gd 3.031; Dy 3.119; Ho 3.149; Er 3.205; Yb 3.315; Cp 3.333. The conclusions are corroborated by work of Bourion on chlorides (C. A. 4, 3174), Jantsch on double nitrates (C. A. 7, 2166), Katz and James (C. A. 8, 2130) and Brauner (C. A. 2, 3320) on chemical properties of rare earths. Similar results were recently reported by Goldschmidt (C. A. 19, 2764). B. J. C. VAN DER H.

Remarks on the quantum mechanics of free electrons. WALTER ELSASSER. *Naturwissenschaften* 13, 711(1925).—The motion of slow electrons according to the new theory of Einstein (C. A. 19, 928, 1528) and deBroglie (Thèses, Paris, 1924) (a wave-field, coordinated to every moving particle, det. its kinematics) is discussed and compared with results of Ramsauer (C. A. 18, 16) on the free path of electrons and of Davisson and Kuhnman (C. A. 18, 622) on the reflection of electrons by Pt. A rough analogy between light dispersion and reflection and the corresponding effects for electrons seems to exist.

Determination of the heat of dissociation of the mercury molecule from the band spectra of mercury vapor. ERICH KOERNICKE. *Z. Physik* 33, 219-31(1925).—The absorption band in Hg vapor at 2540 Å. U. is ascribed to Hg₂. From measurements of the intensity of this band at various temps. and pressures the heat of association of Hg vapor is calcd. to be 1.4 kilocalories per mole. F. R. BICHOWSKY

The influence of the density and geometrical dimensions of the stream on the deposit due to streams of molecules. J. ESTERMANN. *Z. Physik* 33, 320-4(1925).—When a stream of metallic vapor impinges on a cold surface a deposit is formed provided the temp. of the surface is below a certain crit. value. From measurements of this crit. temp. as a function of the d. of the vapor, the heat of adsorption of Cd on glass surfaces is calcd. to be about 3.5 kilocalories per mole, that of Cd on Cu 3.0 kilocal., Cd on Ag 5.0 kilocal., Hg on Ag 2.5 kilocal. Edges of the deposit evap. more quickly than the center, probably because of the geometrically greater chance of escape.

F. R. BICHOWSKY

Refraction and electron constraint in ions and molecules. C. P. SMYTH. *Phil. Mag.* 50, 361-75 (1925).—The forces opposing the displacement of the outer electrons in ions and mols. are calcd. from the refractions. When the force cannot be calcd. for an individual electron, the contribution to the refraction of a group of electrons is taken as an inverse measure of the av. force acting upon these electrons. It is found that where unsatn. exists, the constraint upon the electrons is low and that, in general, the forces exerted upon electrons shared between atoms, as well as those acting upon the unshared outer electrons of atoms or ions, decrease as the no. of underlying electron shells increases and increase when the nuclear charge increases without increase in the no. of underlying shells.

S. C. LIND

Atomic models and the dynamide of Lenard. III. The torulus model and the quantum theory. DAN RADULESCU. *Bul. soc. stiinte Cluj* 2, 129-54 (1924); *Chem. Zentr.* 1925, I, 195-6; cf. *C. A.* 18, 2640.—The elementary magnets of ferromagnetic substances can be regarded as stable dynamides, which are formed from the surface or valence electrons. The elementary magnets or dynamides in the interior of the atom have very much more powerful magnetic properties and therefore polymerize, forming a ring the surface of which consists of the rotating electrons. In this ring there is at least 1 free path of radiation for each electron, this property being compatible with the principles of classic electrodynamics even without resort to the Bohr hypothesis. An advantage is seen in the fact that this involves a certain indefiniteness in representing these properties in model form. It is a quantum model in the general meaning of the Planck quantum theory. To obviate this indeterminate character of the model, the valence field must be studied further. In a discussion of its properties, exception is taken to the Bohr quantum theory in that the elementary laws of mechanics, electrostatics and electrodynamics of the mol. systems are directly applicable to micro-systems, atoms, ions and electrons. In the formation of the ring from the individual dynamides, a no. of electrons are emitted as α -rays. The ring, which accordingly becomes positive, is said, by means of a loosely bound valence electron. This electron is, however, to be distinguished from those of the dynamides in a state of static equil., like the electrons of the model of J. J. Thomson. The at. models are in general all composed of 3 rings located perpendicular to each other. On the surface of the sphere formed by these rings the same fields of force for the electrons exist which Starck assumed, though unacquainted with the inner structure of the atom. The model leads in the case of C to a tetrahedral arrangement of the valences. Every element tends to form a sym. surface field by the acquisition or elimination of electrons, under which circumstances the no. of valence electrons cannot exceed 7. The elements which in a neutral condition have their valence fields unoccupied or symmetrically arranged comprise the noble gases. The advantages of this model over that of the Bohr model are described. Certain conclusions are also drawn from the theory in regard to absorption spectra and the relations between color and chem. constitution. Likewise the bathochromatic effects of auxochromism, halochromism and chromatic isomerism are correlated. C. E. L.

Theory of emission of a model Rutherford-Bohr atom. J. PALACIOS. *Analés soc. españ. fis. quím.* 23, 259-76 (1925).—Assuming that emission from a Bohr atom produces undamped wave trains and that loss of electrons is governed by the law of probability, a theory is developed which satisfactorily explains the Wien measurements on luminosity of canal rays. From this theory and from exptl. measurements it follows that the H and H lines have the same emission time. If this is generally true the Planck const. h could be considered as the product of 2 universal const's of time and energy quantities. Their order of magnitude is given. From this theory and from exptl. measurements of damping it is possible to calc. the degree of stability of the different orbits.

E. M. SYMMES

A theoretical study of the stopping power of hydrogen atoms for α -particles. R. H. FOWLER. *Proc. Cambridge Phil. Soc.* 22, 793-803 (1925).—A mathematical reëxamin. of the theory carried through a second approximation leads to results in satisfactory agreement with those from expts.

F. O. ANDEREGG

The theory of the influence of magnetic fields on the stopping power of gases for α -particles. R. DE L. KRONIG. *Proc. Cambridge Phil. Soc.* 22, 773-8 (1925).—A theoretical consideration of the effect of large magnetic field on the stopping power of gases for α -particles seems to show that in mol⁹ H₂ a positive result should be obtained.

F. O. ANDEREGG

Possible mechanisms of atomic disintegration by α -rays. GERHARD KIRSCH. *Physik. Z.* 26, 457-65 (1925).—Exptl. data of Rutherford and Chadwick on the at. disruption of N by swift α -rays (cf. *C. A.* 15, 2278; 16, 526; 18, 3531) are readily interpreted by K.'s "explosion" hypothesis (*C. A.* 18, 2103). This assumption that the α -particle

communicates its energy to the N nucleus through the formation of an intermediate product of high instability and that this unstable nucleus (an isotope of F of wt. 18) decomposes explosively with emission of a fast proton, is considered more probable than Rutherford's satellite theory. There is no evidence that H particles can occupy outer energy levels in the nucleus. Calculations are made which show that the postulated F (18) isotope is energetically conceivable, and that its instability (due to temporary storage of the energy of the incident α -ray) is consistent with the high abs. velocity of the ejected proton, calculated from Geiger's law connecting range with velocity, $R = av^3$. This new theory develops, therefore, a direct association between absorption of α -rays by light nuclei and the giving off of H-particles. With ejection of an H-particle, the nucleus suffers a general shattering. Reorganization, under the influence of coulomb forces, is almost immediate, however. The present views are contrasted with Rutherford's earlier theory of nucleus structure.

H. R. MOORE

Atomic decomposition by α -particles. II. A method for observing the atomic fragments of short range. GERHARD KIRSCH AND HANS PETTERSSON. *Sitzb. Akad. Wiss. Wien* 133, IIa, 235-41 (1925).—A method is described for observing α -fragments which originate from α -nuclei broken up by α -particles perpendicular to the incident direction of the primary ray. Two different models of the app. are described and the theoretical serviceability of the method for various elements is discussed.

M. F.

The preparation of radium C. II. GUSTAV ORTNER AND HANS PETTERSSON. *Sitzb. Akad. Wiss. Wien* 133, IIa, 229-34 (1925); cf. C. A. 17, 3644.—Several new forms of the app. formerly described for the prepn. of strong and very small disks of Ra C by condensing Rn with liquid air are given.

MARIE FARNSWORTH

The maximum range of particles expelled by radium C. DAGMAR PETTERSSON. *Sitzb. Akad. Wiss. Wien* 133, IIa, 149-62 (1925); cf. C. A. 18, 2104.—Using very careful exptl. methods, P. attempts to verify the long-range H- and α -particles from Ra C recorded by Bates and Rogers (cf. C. A. 18, 14, 1428). The no. of H-particles found is much smaller than that found by B. and R. and varies with exptl. conditions. These are clearly of secondary origin. The 2 more rapid groups of α -particles, ranges 11.2 and 13.3 cm., can be completely eliminated. The existence of the third group, range 9.3 cm., is in doubt.

MARIE FARNSWORTH

The measurement of the relative brightness of scintillations. ELISABETH KARAMICHAILOVA AND HANS PETTERSSON. *Sitzb. Akad. Wiss. Wien* 133, IIa, 163-8 (1925); cf. C. A. 18, 2144.

MARIE FARNSWORTH

The radioactivity and more recent investigations of the springs of Taunus. F. HENRICH. *Z. angew. Chem.* 38, 472-6 (1925).—Two types of springs were studied: those which were dependent wholly or partially on art. pptn. and those from purely underground sources. The activity in all cases was only weak or medium strong.

MARIE FARNSWORTH

The irregularity in the β -rays of freshly crystallized uranium nitrate. JULIUS KORCZYK. *Sitzb. Akad. Wiss. Wien* 133, IIa, 225-7 (1925).—The irregularity in the β -ray activity is due to the diffusion of U X into the layer of salt. This irregularity can be practically eliminated by the addn. of an Fe salt which hinders the diffusion.

M. F.

The isotopes of uranium. OTTO HAHN. *Z. anorg. allgem. Chem.* 147, 16-23 (1925).—From the at. wt. of Ra, which is known accurately, that of U should be 237.92, but the best exptl. value is 238.18. Several theories have been offered to account for the discrepancy. The most probable by Russell (C. A. 18, 13) proposes an isotope, actinouranium I, of at. wt. 239. This could not be found directly; but a hypothetical degradation product, U XV, to which was assigned a half life of 20 yrs. and which would be an isotope of U X and ionium, should affect the rate of production of protactinium and the activity of U X. Neither effect was observed, but its absence could not be proved. The question might be decided by ascertaining, by the Aston mass spectrum, whether the at. wt. of protactinium is 230 or 231.

A. W. FRANCIS

Ionium. O. KOBLIC. *Chem. Listy* 19, 185-7 (1925).—In the extn. of U ores the only radio-element conserved thus far has been Ra. Io is capable of replacing Ra for certain uses, e. g., in the prepn. of luminescent paints, etc. For every mg. Ra present in the ore there are approx. 60 mg. Io, the greater part of which is concd. in the carbonate ppt. obtained in the extn. of the ore. Work is in progress to det. the feasibility of conserving this element.

F. C. KRACEK

The radioactivity of some cold springs in the Bagneres de Luchon region and its origin. ADOLPHE LEPAPE. *Compt. rend.* 181, 112-4 (1925); cf. C. A. 17, 2819.—The radioactivity is ascribed to surface waters since the region contains much white mica, which is rich in Ra. It is due to Rn rather than Ra, since the warm springs are much less radioactive, though they contain more Ra.

A. W. FRANCIS

the concn. of electrons in it. On immersing a metal in water or a soln. of its salt an equil. is established between its atoms, ions and electrons, and the solvates of its ions, by which the value and the sign of potential difference metal-soln. is determined. The electrolytic soln. pressure must be due to 2 factors: dissociation within the metal of its atoms into ions and electrons, and the electrostatic attraction between the ions of the metal and the mols. of the solvent. The suppositions of the osmotic theory of current flow then follow as a consequence from the above equil. between the atoms, ions and electrons on the one hand and its ions, mols. of the solvent and its solvated ions on the other. The magnitude of the potential of a metalloid immersed in a soln. of its ions depends not only on the chem. nature of the element and the degree of tendency of its atoms to unite with electrons, but also on the degree of dissociation of the metal of the electrode into ions and electrons. VI. *Ibid* 798-804.—The reaction $2\text{Fe}^{++} + \text{Sn}^{++} \longrightarrow \text{Sn}^{+++} + 2\text{Fe}^{+}$ can be speeded by the addn. of an ion of high mobility, e. g., H^{+} which acts here as an agent for transferring the electrons from one ion to another ion of a like charge. Certain cases of *catalytic action* as of Pt on $2\text{H}_2 + \text{O}_2 = 2\text{H}_2\text{O}$, can be explained by the action of electrons present in a metal by virtue of dissociation of its atoms into ions and electrons. A. C. ZACHLIN

The photoelectric effect in potassium vapor as a function of the frequency of the light. E. O. LAWRENCE *Phil Mag.* 50, 345-59 (1925).—In a stream of K vapor, light of wave length greater than 2610 Å. U. produces no photoelec. effect. The efficiency of producing ionization increases for shorter wave lengths. On account of disagreement with the Bohr theory of spectroscopic data as applied to K vapor, the observed photoelec. effects are attributed to mol. K vapor. S. C. LIND

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The calculation of the X-ray diffracting power at points in a crystal. WM. DUANE. *Proc. Nat. Acad. Sci.* 11, 489-93 (1925).—An application of Epstein's and Ehrenfest's (*Proc. Nat. Acad. Sci.* 10, 133 (1924)) quantum treatment of the problem of Fraunhofer diffraction to the detn. of the distribution of X-ray diffracting power in a crystal. The general term in the Fourier's series representing the d. of diffracting power ρ_{xyz} at a point (xyz) in the unit cell of the crystal is $A_{n_1 n_2 n_3} \sin(2\pi n_1 x/a_1 - \epsilon_{n_1}) \sin(2\pi n_2 y/a_2 - \delta_{n_2}) \sin(2\pi n_3 z/a_3 - \delta_{n_3})$, where A is a coeff. depending upon $n_1 n_2 n_3$, which are whole nos. a_1 , a_2 , and a_3 are the lengths of the edges of the unit parallelepiped, and the δ 's are phase angles. The δ 's may be evaluated for some crystals by a consideration of symmetry conditions, and certain of the coeffs. A are found to be equal to each other. The Fourier's series represents the distribution in space of the time av. of the electron d., on the assumption that this d. is proportional to the time av. of the X-ray diffracting power. R. J. HAVIGHURST

The distribution of diffracting power in sodium chloride. R. J. HAVIGHURST. *Proc. Nat. Acad. Sci.* 11, 502-7 (1925).—The use of Duane's ideas (cf. preceding abstr.) leads to the following expression for the d. of X-ray diffracting power at a point (xyz) in the unit cube of a crystal of NaCl: $\rho_{xyz} = \sum_{n_1} \sum_{n_2} \sum_{n_3} A_{n_1 n_2 n_3} \cos 2\pi n_1 x/a \cos 2\pi n_2 y/a \cos 2\pi n_3 z/a$, where n_1 , n_2 and n_3 are the Miller indices of the different crystal planes multiplied by the no. representing the order of reflection; a is the length of side of the unit cube; $A_{n_1 n_2 n_3}$ is the sq. root of the intensity of reflection for the plane ($n_1 n_2 n_3$)

and has the same value for all combinations of these nos. On certain assumptions the d of diffracting power may be identified with the "electron density." The exptl. values of Bragg, James, and Bosanquet for the intensity of reflection of X-rays by rock-salt were corrected and used in the calcn of the A's. Curves show the distribution of electron d along the cube edge, face diagonal and body diagonal of the unit cube. The relative aints. of diffracting power in the 2 atoms are detd by plotting ρ^2 against r , where r is distance from the center of the atom. The area under the curve represents the relative amt. of diffracting power. The ratio for Cl:Na is 1.78:1, while the ratio of the nos. of electrons (ionized atoms) is 1.8:1. These curves indicate the existence of 2 shells of electrons in Cl and 1 shell in Na.

R. J. HAVIGHURST

The distribution of diffracting power in certain crystals. R. J. HAVIGHURST. *Proc. Nat. Acad. Sci.* 11, 507-12(1925); cf. two preceding abstracts.—The distribution of X-ray diffracting power is calcd. for KI, NH_4I , NH_4Cl and diamond, with the aid of intensity estimates of the reflections on powder method photographs. The "electron density" curves show sharp peaks at the at positions in the lattice. The heights of these peaks vary with the diffracting power of the atoms. For diamond, 2 Fourier's series, 1 for each of the 2 interpenetrating face-centered lattices, must be combined in the expression for the d.

R. J. HAVIGHURST

The energy reappearing as characteristic X-rays when X-rays are absorbed in copper. G. R. M. JAUNCEY AND O. K. DEFOE. *Proc. Nat. Acad. Sci.* 11, 520-2 (1925).—The fluorescent coeff. of Cu for X-rays of effective wave length 0.385 Å. U. is measured. By far the larger part of the energy absorbed goes into the photoelectric ejection of K electrons.

R. J. HAVIGHURST

The measurement of X-ray intensity by ionization methods. L. H. CLARK. *Brit. J. Radiology* 21, 21-8(1925).—When X-rays strike the electrodes or inner walls of an ionization chamber, secondary radiation is produced which differs in quality and quantity with the wave length of the impinging radiation. Therefore, it is impossible by means of such ionization chambers to make reliable comparisons of the intensities of X-ray beams of different wave length. C. has devised an "air-gap" ionization chamber through which the beam may pass without falling upon any material of the app. The only source of secondary radiation is the air in the gap, and this is shown to be insignificant.

E. H. QUIMBY

Suitability of the Seemann "edge method" for measurements of X-ray standards. A. P. WEBER. *Z. wiss. Phot.* 23, 149-83(1925); *J. Chem. Soc.* 128, II, 458(1925).—Rigorous tests have established the accuracy of the app. for estms. of abs. values of X-ray wave lengths and for general precision measurements. Accurate detns. are made of $K\alpha_1$ lines of Cu, Zn, Ag, Fe, Pb, Pt and in some instances of $K\alpha_2$ and $K\beta_1$ lines of the same elements. Possible errors due to position of the spectrometer crystal and broadening of lines are discussed. Bragg's method is handicapped by penetration of the rays in the crystal, and this factor is probably wholly negligible in the present method. H. R. M.

An X-ray spectroscopic method for quantitative chemical analysis. PAUL GÜNTHER AND GERTRUD WILCKE. *Ann.* 440, 203-12(1924); cf. *C. A.* 19, 2610.—A mixt. of Fe and Co oxides is deposited on a Ag cathode of an X-ray tube. The small current necessary is supplied from either a small transformer or an induction coil. The $K\alpha$ lines of Fe and Co are resolved by the reflection method by a CaF_2 crystal. The relative intensities of the 2 lines on a photographic plate are detd by counting and evaluating the av. d. of distribution of Ag particles under 800 magnification. Correction is made for the blackening of the film due to diffuse radiation by detg. the av. no. of particles in the film at points on the border of the $K\alpha$ lines. The X-ray method gave results agreeing within 2% with gravimetric detn. The method is to be applied to the rare earths.

D. C. BARDWELL

Relations of the pp' groups in atoms of the same electronic structure. I. S. BOWEN AND R. A. MILLIKAN. *Phys. Rev.* 26, 150-64(1925); cf. *C. A.* 19, 2781.—The pp' groups in the hot spark spectrum of two-valence-electron and three-valence-electron atoms are shown to arise from the simultaneous jumping of 2 electrons in which the combined energy of the 2 changes is integrated into monochromatic radiation. The ionization potential of an atom must depend upon the state of the p electron after an s electron is removed.

D. C. BARDWELL

Line breadths and absorption probabilities in sodium vapor. G. R. HARRISON AND J. C. SLATER. *Phys. Rev.* 26, 176-88(1925); cf. *Phys. Rev.* 25, 768; *C. A.* 19, 2781.—The broadening of the absorption lines of the principal series of Na is so great as to indicate that there is present a large proportion of diatomic Na mols. at high temps. (600°). The proportion increases with temp., suggesting that the energy of dissociation of Na_2 at zero abs. may be negative.

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the concn. of electrons in it. On immersing a metal in water or a soln. of its salt an equil. is established between its atoms, ions and electrons, and the solvates of its ions, by which the value and the sign of potential difference metal-soln. is determined. The electrolytic soln. pressure must be due to 2 factors: dissociation within the metal of its atoms into ions and electrons, and the electrostatic attraction between the ions of the metal and the mols. of the solvent. The suppositions of the osmotic theory of current flow then follow as a consequence from the above equil. between the atoms, ions and electrons on the one hand and its ions, mols. of the solvent and its solvated ions on the other. The magnitude of the potential of a metalloid immersed in a soln. of its ions depends not only on the chem. nature of the element and the degree of tendency of its atoms to unite with electrons, but also on the degree of dissociation of the metal of the electrode into ions and electrons. VI. *Ibid* 798-804.—The reaction $2\text{Fe}^{++} + \text{Sn}^{++} \rightarrow \text{Sn}^{+++} + 2\text{Fe}^{+}$ can be speeded by the addn. of an ion of high mobility, e. g., H^{+} which acts here as an agent for transferring the electrons from one ion to another ion of a like charge. Certain cases of catalytic action as of Pt on $2\text{H}_2 + \text{O}_2 = 2\text{H}_2\text{O}$, can be explained by the action of electrons present in a metal by virtue of dissociation of its atoms into ions and electrons.

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The calculation of the X-ray diffracting power at points in a crystal. WM. DUANE. *Proc. Nat. Acad. Sci.* 11, 489-93 (1925).—An application of Epstein's and Ehrenfest's (*Proc. Nat. Acad. Sci.* 10, 133 (1924)) quantum treatment of the problem of Fraunhofer diffraction to the detn. of the distribution of X-ray diffracting power in a crystal. The general term in the Fourier's series representing the d. of diffracting power p_{xyz} at a point (xyz) in the unit cell of the crystal is $A_{n_1 n_2 n_3} \sin(2\pi n_1 x/a_1 - \delta_{n_1}) \sin(2\pi n_2 y/a_2 - \delta_{n_2}) \sin(2\pi n_3 z/a_3 - \delta_{n_3})$, where A is a coeff. depending upon $n_1 n_2 n_3$, which are whole nos.; a_1 , a_2 and a_3 are the lengths of the edges of the unit parallelepiped, and the δ 's are phase angles. The δ 's may be evaluated for some crystals by a consideration of symmetry conditions, and certain of the coeffs. A are found to be equal to each other. The Fourier's series represents the distribution in space of the time av. of the electron d., on the assumption that this d. is proportional to the time av. of the X-ray diffracting power.

R. J. HAVIGHURST

The distribution of diffracting power in sodium chloride. R. J. HAVIGHURST. *Proc. Nat. Acad. Sci.* 11, 502-7 (1925).—The use of Duane's ideas (cf. preceding abstr.) leads to the following expression for the d. of X-ray diffracting power at a point (xyz) in the unit cube of a crystal of NaCl: $\rho_{xyz} = \sum_{n_1} \sum_{n_2} \sum_{n_3} A_{n_1 n_2 n_3} \cos 2\pi n_1 x/a \cos 2\pi n_2 y/a$

$\cos 2\pi n_3 z/a$, where n_1 , n_2 and n_3 are the Miller indices of the different crystal planes multiplied by the no. representing the order of reflection; a is the length of side of the unit cube; $A_{n_1 n_2 n_3}$ is the sq. root of the intensity of reflection for the plane $(n_1 n_2 n_3)$

and has the same value for all combinations of these nos. On certain assumptions the d. of diffracting power may be identified with the "electron density." The exptl. values of Bragg, James and Bosanquet for the intensity of reflection of X-rays by rock-salt were corrected and used in the calcn. of the A 's. Curves show the distribution of electron d. along the cube edge, face diagonal and body diagonal of the unit cube. The relative amts. of diffracting power in the 2 atoms are detd. by plotting ρ^2 against r , where r is distance from the center of the atom. The area under the curve represents the relative amt. of diffracting power. The ratio for Cl:Na is 1.78:1, while the ratio of the nos. of electrons (ionized atoms) is 1.8:1. These curves indicate the existence of 2 shells of electrons in Cl and 1 shell in Na.

R. J. HAVIGHURST

The distribution of diffracting power in certain crystals. R. J. HAVIGHURST. *Proc. Nat. Acad. Sci.* 11, 507-12(1925); cf. two preceding abstracts.—The distribution of X-ray diffracting power is calcd. for KI , NH_4I , NH_4Cl and diamond, with the aid of intensity estimates of the reflections on powder method photographs. The "electron density" curves show sharp peaks at the at. positions in the lattice. The heights of these peaks vary with the diffracting power of the atoms. For diamond, 2 Fourier's series, 1 for each of the 2 interpenetrating face-centered lattices, must be combined in the expression for the d.

R. J. HAVIGHURST

The energy reappearing as characteristic X-rays when X-rays are absorbed in copper. G. E. M. JAUNCEY AND O. K. DEFOE. *Proc. Nat. Acad. Sci.* 11, 520-2 (1925).—The fluorescent coeff. of Cu for X-rays of effective wave length 0.385 Å. U. is measured. By far the larger part of the energy absorbed goes into the photoelec. ejection of K electrons.

R. J. HAVIGHURST

The measurement of X-ray intensity by ionization methods. L. H. CLARK. *Brit. J. Radiology* 21, 21-8(1925).—When X-rays strike the electrodes or inner walls of an ionization chamber, secondary radiation is produced which differs in quality and quantity with the wave length of the impinging radiation. Therefore, it is impossible by means of such ionization chambers to make reliable comparisons of the intensities of X-ray beams of different wave length. C. has devised an "air-gap" ionization chamber through which the beam may pass without falling upon any material of the app. The only source of secondary radiation is the air in the gap, and this is shown to be insignificant.

E. H. QUIMBY

Suitability of the Seemann "edge method" for measurements of X-ray standards. A. P. WEBER. *Z. wiss. Phot.* 23, 149-83(1925). *J. Chem. Soc.* 128, II, 458(1925).—Rigorous tests have established the accuracy of the app. for estns. of abs. values of X-ray wave lengths and for general precision measurements. Accurate detns. are made of $K\alpha_1$ lines of Cu, Zn, Ag, Fe, Pb, Pt and in some instances of $K\alpha_2$ and $K\beta_1$ lines of the same elements. Possible errors due to position of the spectrometer crystal and broadening of lines are discussed. Bragg's method is handicapped by penetration of the rays in the crystal, and this factor is probably wholly negligible in the present method.

E. R. M.

An X-ray spectroscopic method for quantitative chemical analysis. PAUL GÜNTHER AND GERTRUD WILCKE. *Ann.* 440, 203-12(1924); cf. *C. A.* 19, 2610.—A mixt. of Fe and Co oxides is deposited on a Ag cathode of an X-ray tube. The small current necessary is supplied from either a small transformer or an induction coil. The $K\alpha$ lines of Fe and Co are resolved by the reflection method by a CaF_2 crystal. The relative intensities of the 2 lines on a photographic plate are detd. by counting and evaluating the av. d. of distribution of Ag particles under 800 magnification. Correction is made for the blackening of the film due to diffuse radiation by detg. the av. no. of particles in the film at points on the border of the $K\alpha$ lines. The X-ray method gave results agreeing within 2% with gravimetric detn. The method is to be applied to the rare earths.

D. C. BARDWELL

Relations of the pp' groups in atoms of the same electronic structure. I. S. BOWEN AND R. A. MILLIKAN. *Phys. Rev.* 26, 150-64(1925); cf. *C. A.* 19, 2781.—The pp' groups in the hot spark spectrum of two-valence-electron and three-valence-electron atoms are shown to arise from the simultaneous jumping of 2 electrons in which the combined energy of the 2 changes is integrated into monochromatic radiation. The ionization potential of an atom must depend upon the state of the p electron after an s electron is removed.

D. C. BARDWELL

Line breadths and absorption probabilities in sodium vapor. G. R. HARRISON AND J. C. SLATER. *Phys. Rev.* 26, 176-88(1925); cf. *Phys. Rev.* 25, 768; *C. A.* 19, 2781.—The broadening of the absorption lines of the principal series of Na is so great as to indicate that there is present a large proportion of diatomic Na mols. at high temps. (600°). The proportion increases with temp., suggesting that the energy of dissociation of Na_2 at zero abs. may be negative.

D. C. BARDWELL

The absorption spectrum of lead vapor in the ultra-violet. R. V. ZUMSTEIN. *Phys. Rev.* **26**, 189-94 (1925).—The absorption spectrum of Pb vapor was photographed from 5000 to 2000 Å. U. at temps. up to 1600°. Thirty-four lines were found which are interpreted by the energy diagram of Thorsen and Grottrian (cf. *C. A.* **18**, 3542). The arc spectrum of Pb was photographed to 2000 Å. U. D. C. BARDWELL

Wave lengths and pressure-shifts in the spectrum of magnesium. MAX PETERSEN AND J. B. GREEN. *Astrophys. J.* **62**, 49-60 (1925).—The second, third and fifth orders of a 21-ft. concave grating spectrograph were employed to photograph the arc spectrum of Mg as emitted in air and in vacuum. Wave lengths were detd. with reference to standard Fe lines. Care was taken to employ long arcs so that pole-effects would be eliminated, leaving the differences in wave length between air and vacuum to be interpreted as pressure-shifts. These are, in general, smaller than similar results previously found by others. Correlations of the observed shifts with the series classification of the lines show increase of pressure-shift with increasing term value, but the law of increase is not evident. The idea that the pressure-shifts are asymmetrical Stark effects occurring in the heterogeneous elec. fields of the source is partially confirmed. No shifts to the violet were observed. C. C. KIESS

A three-dimensional method of representing quantum transitions in band spectra. H. B. LEMON AND C. M. BLACKBURN. *Astrophys. J.* **62**, 61-4 (1925).—Just as the energy changes involved in at. emission may be represented by coplanar lines called energy levels, so a series of parallel planes in a three-dimensional model may be employed to represent the energy changes that occur in mols. with the emission of band spectra. The application of such a model to the first negative band system of C is described. C. C. KIESS

The behavior of some spark lines of carbon in an electric field. SUNAO NAKAMURA AND YOSHIO FUJIOKA. *Sci. Papers Inst. Phys. Chem. Research (Japan)* **3**, 155-62 (1925) (in English).—The close pairs of C⁺ lines 4267, 3920, 2992, 2837 and 2747 Å. U. were studied when excited in an elec. field with a view to det. their Stark effects. Broadening was observed for some of the lines, but it is not possible to decide whether it is a Stark effect of an extraordinary nature or the intrusion of a Doppler effect into the phenomena. C. C. KIESS

The spectrum of ionized calcium (Ca II). F. A. SAUNDERS AND H. N. RUSSELL. *Astrophys. J.* **62**, 1-7 (1925).—New observations of the spark spectrum of Ca have been made in nearly all parts of the spectrum and with a variety of sources. The new wave lengths have been used in working out the series which is of the same kind as that which occurs in Mg II. In addn. to assigning second and third members to the principal series $1s-m\pi$, the present work gives the series $2\pi-m\sigma$, $2\pi-m\delta$ and $3\phi-m\phi'$, and various combination series. The complete classification of lines and combining terms is tabulated. C. C. KIESS

The structure of the near infra-red absorption bands of water vapor. W. W. SLEATOR AND E. R. PHELPS. *Astrophys. J.* **62**, 28-48 (1925).—The near infra-red absorption spectrum of water vapor was explored with a thermopile to detect the fine structure of the bands at 1.38μ , 1.87μ , 3.11μ and 6.26μ . With a grating ruled 2880 lines per in. 126 lines were measured in the 6.26μ band. In the 3.11μ band 56 lines were measured, a grating with 7200 lines per in. being used. Gratings of 15,000 and 20,000 lines per in., resp., were used for the 1.87μ and 1.38μ bands, in which there were measured 52 and 28 lines, resp. The data are presented in tables. C. C. KIESS

New investigations of spark spectra in the Schumann region. LÉON AND EUGÈNE BLOCH. *J. phys. radium* [VI] **6**, 154-65 (1925).—Continuing previous work (*C. A.* **19**, 2783) the present paper gives details of the wave-length measurements in the extreme ultra-violet spark spectra of Mn, Cr, Cu, Ag, Au and Pt. C. C. KIESS

The band spectra of aluminium. WALTER MÖRIKÖFER. *Verhandl. Naturforsch. Ges. Basel* **36**, 35-110 (1924-5).—Grating and prism spectrographs were employed to photograph the band spectra emitted in the arc and spark between Al electrodes. The ordinary band spectrum of Al, attributed to the oxide, has been increased from 36 to 71 members which are shaded toward the red. These bands are emitted at low excitation stages in the arc and may be observed in the center and in the aureole of the arc. These bands are resolvable into 8 groups, the band-heads in any group forming a series of the Deslandres type: $\nu = A - B_n + Cn^2$, in which ν is the wave no. of a band head, A , B and C are consts. for a series, and n is a variable taking successive integral values beginning with 1. Inasmuch as any series may be superposed on any other by changing the wave nos. of its members by a const. it is possible to represent all the members of the 8 groups by one formula: $\nu = 74867.48 - 139.06n + 3.327n^2 - 685.52g - 7.16g^2$, in which for any value of g from 1 to 8, n runs through the integral values 1 to 18.

When the Al arc burns in an atm. of H at normal pressure, a new set of blue and violet bands is emitted which are ascribed to the hydride. They appear most prominently at the positive pole, and require an intense excitation of the mol. for their appearance. In the 8 bands, which are shaded toward the red, about 130 lines have been measured. These lines, which to the eye appear to have a regular distribution, can only be represented by complex formulas of the 3rd, 4th or 5th degree. In addn. to the oxide and hydride bands, other bands shaded toward the violet have been measured between 4642 Å. U. and 4390 Å. U., and a band shaded toward the red at 4546 Å. U. Attempts to det. the type of mol. which emits them were unsuccessful.

C. C. KIESS

The displacement rule for band spectra. R. MECKE. *Naturwissenschaften* 13, 698-9(1925).—M. shows that 3 parts of the band spectrum of C can be represented as combinations of 3 doublet terms, probably due to ionized (CO)⁺. The same 3 terms were found in the spectrum of BO. Another example of the displacement rule for line spectra is the similarity in term and structure for ionized (N₂)⁺ and CN. It is assumed that all 4 gases are built up alike with an electron octet surrounding 2 kernels and a valence electron outside; from the spectral similarity between CO and BO rather than between CO and CN it follows that C in the former case is the bearer of the ionization charge.

B. J. C. VAN DER HOEVEN

Regularities in the tungsten arc spectrum. OTTO LAPORTE. *Naturwissenschaften* 13, 627-8(1925).—Preliminary report. The s term does not represent the normal state of the W atom. It lies between D₁ and D₂. Some 200 lines were identified; 63 higher levels have been found.

B. J. C. VAN DER HOEVEN

Selective inversion of the mercury line 4358. RITA BRUNETTI. *Nuovo cimento* [N. S.] 1, 277-81(1924).—B. has compared the data obtained by him with those of other investigators (Wood, Nagaoka and Takamine, Nagaoka) and reaches the general conclusion that there is a principal component which is most sensitive to absorption and inversion. This sensitivity decreases symmetrically to the right and left of the radiation of the central group. There is furthermore a great difference between absorption of the central and lateral groups of satellites.

I. T. FAIRHALL

Optical screening-constant regularities. A. C. MENZIES. *Phil. Mag.* 50, 414-22(1925).—Screening-consts. have been calcd. for the optical doublets and triplets of several chem. groups of atoms by application of the relativity doublet formula. In passing down a chem. sub-group of the periodic table the screening-const. varies directly as the at. no. For many such sub-groups the change in s has approx. const. values in passing from one element to the next; for Z = 8, 18, 32 s is nearly 5, 13, 23, resp. These nos. are shown to be of the order to be expected on simple considerations. The significance of the formula is discussed in the light of the probability that the origin of multiplets is magnetic rather than relativistic.

S. C. LIND

Lithium arc spectrum for polarimetric use. P. C. AUSTIN. *J. Chem. Soc.* 127, 1752-3(1925).—By introducing Li₂CO₃ into an elec. arc produced between Cu electrodes set at right angles to each other and using a direct-vision spectroscopic eyepiece of high dispersive power, it is possible to read extinctions easily, not only for the red line at λ = 6708 Å. U., but also for the orange line at λ = 6104 Å. U., the blue line at λ = 4602 Å. U., and sometimes even the green line at λ = 4972 Å. U. The blue line is a valuable addn. to the list of lines in common use in measurements of optical rotatory dispersion. The red and blue lines of Li are widely sepd. and can be read with sufficient accuracy to enable them to serve as standards.

R. I. DODGE

Ultra-violet absorption spectra of the alkaloids of the tropane group. A. CASTILLE. *Bull. acad. roy. med. Belg.* [5] 5, 193-200(1925).—The results are given of elaborate measurements of the absorption spectra of the following alkaloids: (1) cocaine-HCl; (2) cocaine, both in alc.; (3) the sulfates of atropine and of hyoscyamine in water—both showing exactly the same spectrum, as they are stereoisomers; (4) atropine in alc.; (5) benzoic acid, dissolved in hexane. The change of the mol. coeff. of absorption is plotted as a curve for these substances. The most remarkable fact is that benzoic acid and cocaine have almost the same curve. The absorption of cocaine seems to be due, therefore, chiefly to the benzoyl group contained in its mol. Salts show about the same absorption as the free alkaloids. Cocaine presents 3 characteristic bands at the wave lengths of 2330 and of 2750 Å. U., atropine has chiefly 1 strong band at 2580 Å. U. By measuring the intensity of absorption at these wave lengths, the alkaloidal content of solns. can be detd. accurately to 0.1 mg.

R. B.

The ultra-red emissivity of several oxides. H. SCHMIDT-REPS. *Z. tech. Physik* 6, 322-5(1925).—A lab. method has been worked out for measuring the spectral emis-

sivity at well-defined true temps. Ceria, thoria, Cr oxide and the Welsbach mixt. have been studied, curves for which are given. These curves show the very strong selectivity of the radiation for the Welsbach mixt. and for thoria, as compared to those for Cr oxide and for ceria. J. H. PERRY

The applicability of the tungsten arc lamp for the production of ultra-violet radiation. W. W. LOEBE AND W. LEDIG. *Z. tech. Physik* 6, 325-7 (1925).—The permeability of different kinds of glass for radiations in the ultra-violet region is briefly reported. It is shown that in the production of ultra-violet radiation the W arc lamp is more suitable than the W incandescent lamp insofar as a pure continuous spectrum is not required. J. H. PERRY

Doppler effect in the reflection of resonance fluorescence. W. RUMP. *Z. Physik* 29, 196-208 (1924).—It is shown that a reëmitted line in a resonance fluorescence spectrum shows a greater Doppler effect than that of the incident radiation when the source of secondary radiation is at a higher temp. than that of the primary radiation. The width of a line is unchanged by reflection from glass, metal or Hg vapor. B. C. A.

Extreme ultra-violet spectrum of germanium and scandium. H. J. C. IRETON. *Trans. Roy. Soc. Canada* [iii] 18, III, 103-9 (1924).—The spark spectrum of Ge has been extended from 2138.7 to 3197 Å. U., 64 new lines being recorded. The spark spectrum of Sc has been extended from 2233.7 to 5070, 45 new lines being observed. B. C. A.

Temperature displacements in the spectra of germanium and chlorine. J. LUNT. *Month. Not. Roy. Astr. Soc.* 85, 118-56 (1924); *Science Abstracts* 28A, 296. —The spectra of GeCl_4 in vacuum tubes are investigated and it is shown that temp. shifts of the lines can be observed by working with various intensities of discharge which are greatly in excess of any temp. shifts hitherto observed. Thus for the 2 red lines of Ge there is an observed shift between the limits of the conditions of 1.5 and 1.6 Å. U. towards the red for the higher temp. In the Cl spectrum there seem to be 2 well-defined groups of lines, one of which is subject to temp. displacement while the other is not. It is suggested that the interpretations of a good many astrophysical observations may have to be reconsidered since the Doppler velocities and pressures which have been deduced are not always at all satisfactory. A series of notes on previous work on temp. shifts is given, as well as tables of wave lengths and temp. shifts of Cl lines and reproductions of plates showing them. H. G.

The spectrum of germanium. J. LUNT. *Month. Not. Roy. Astr. Soc.* 85, 38-46 (1924); *Science Abstracts* 28A, 296. —The spectrum of Ge is photographed with GeCl_4 in vacuum tubes, and the lines are tabulated and compared with the arc lines. Remarkable temp. shifts are noted. New lines due to Cl are also obtained. H. G.

Secondary spectrum of hydrogen. J. W. NICHOLSON. *Month. Not. Roy. Astr. Soc.* 85, 49-64 (1925).—The Fulcher H bands are to be regarded as 2 parts of a single band system of great complexity, which is probably due to un-ionized H mols. The lines of these bands do not show the Zeeman effect. The most characteristic components in the first Fulcher band are in each case arranged in triplets about 100 Å. U. apart. In addn. to the strong lines noted by Fulcher, it is shown that practically all the weak lines in the region 6000-6400, not showing the Zeeman effect, are to be regarded as components of a single scattered band. Similarly, groups of lines in the region 5300-5700 are related to the second Fulcher band, the chief components of which are triplets of mutual sepn. 120 Å. U. The wave nos. of the strongest components in these 2 bands may be expressed by formulas of the type $n = \alpha + \beta(m + \frac{1}{2})^2$, in which the values of α for the 2 series are approx. equal. The 2 bands thus possess a common limit. Examin. of the lines in the blue region which do not show the Zeeman effect indicates the existence of other widely sepd. bands analogous to those of Fulcher, and the probability that the no. of distinct bands in the secondary spectrum of H is small. B. C. A.

Spectroheliograms with different parts of the H_α line. T. ROYDS. *Month. Not. Roy. Astr. Soc.* 85, 474-6 (1925).—Spectroheliograms obtained when a slit of about 0.5 Å. U. width is set on either the red or violet edge of the H_α line show a bright spot ring, often complete and unbroken, round nearly all sunspots of medium size. At the same time, dark flocculi are produced outside the bright ring, where the H_α line is wider than normal. A less striking feature is a bright surround intervening between the dark flocculus and the coarse network of the general body of the sun. B. C. A.

Relation between the constants of the infra-red bands of triatomic molecules. E. FERMI. *Atti accad. Lincei* [VI] 1, 386-7 (1925).—The theory of infra-red bands leads to the formula $\Delta\nu = h/4\pi^2 I$, where h represents Planck's const., I the moment of inertia of the mol., and $\Delta\nu$ the const. frequency difference between the lines of the infra-red

band. For triatomic mols., the 3 atoms must lie in a plane, and the 3 principal moments of inertia are connected by the expression $I_1^2 = I_2 + I_3$; hence $1/\Delta\nu_1 = 1/\Delta\nu_2 + 1/\Delta\nu_3$. This equation is obeyed closely for water vapor, the mol. of this being the only one for which the necessary exptl. data are available.

The effect of ultra-violet light and X-rays on the stability of matter. A. L. FOLEY. *Proc. Indiana Acad. Sci.* **34**, 185-93 (1925).—Two quartz and 2 glass tubes of the dumb-bell type of each of the gases, A, Br, Cl, CO₂, He, H, I, N, O, SO₂, H₂O and Xe, 2 quartz tubes of each of the gases, CO, Kr and Ne, in addn. to 2 glass tubes contg. the c. p. metals, Al, Sb, As, Ba, Bi, Cd, Cu, Mg, Mn, Se, S and Sn all in an atm. of N had been prepd. by Sir Wm. Ramsay. Half the tubes were reserved as controls, while the other quartz tubes were exposed to ultra-violet light and the other glass tubes to X-rays. The contents were periodically observed with the aid of an electrodeless discharge and photographs of the spectra. A large no. of plates were exposed and studied. The most important conclusions reached are: The great deviations in relative intensities of lines and in the appearance of many unmapped lines show the inadequacy of present spectral data in spite of the great amt. of work that has already been done. It is very difficult to get a gas into a tube so that it is spectroscopically pure. It is not easy to make tubes giving similar results. The electrodeless discharge gives results differing from the discharge in tubes contg. electrodes. Hg lines were usually present in all the tubes but diminish in the presence of Al, As, Cu or Sn. In these tubes the vacuum increases with discharging as in electrode tubes. Exposure of metals to X-rays for 160 hrs liberates little or no gas. Changes in the spectra with continued discharge were observed similar to those previously ascribed to leakage or other phenomena connected with the presence of electrodes.

The photosensitivity of ferrocyanides. EMIL BAUR. *Helvetica Chim. Acta* **8**, 403-5 (1925).—Solns. of Na or K ferrocyanide darken in color on illumination. If O₂ is led through the soln. the phenomenon is accentuated, but it takes place also with carefully deaerated freshly prepd. solns. Light is effective whether the solns. are acid or basic, the only difference being that in acid soln. blue color is produced because of the formation of Prussian blue. If the ferrocyanide soln. is passed through a column of granulated Al, the original yellow color of the soln. disappears, and the soln. ceases to be photochem. sensitive. These facts, none of which is new, point to the conclusion that the (Fe(CN)₆)⁴⁻⁻ is photochem. insensitive, the light reaction being due to the photochem. decomposition of the (Fe(CN)₆)³⁻⁻, this ion always being present in small quantities in the ordinary prepn.

Photoluminescence of benzene and derivatives. A. L. REIMANN. *Naturwissenschaften* **13**, 744-5 (1925).—Benzene and some simple derivs (xylenes, cresols, naphthalene) in cryst. form showed strong fluorescence bands, similar (but of longer wave length) to those of the same substances in dil. soln. At liquid-air temp. these bands dissolve into a series of narrow bands, which are different from the "progressive" fluorescence bands, detected by Kowalski. The latter are characteristic for the dissolved state.

Luminescence and reaction velocity. H. BEUTLER AND M. POLANYI. *Naturwissenschaften* **13**, 711-3 (1925).—The reaction velocity and the light phenomena accompanying the reaction were studied for mixts. of Na vapor with several halogen compds. At one end of a 100-cm. heated tube (300-350°) Na vapor of 0.01-0.1 mm. pressure was admitted, at the other end the halogen compd. In the middle of the tube over a range of some 10 cm. the contents emit light and the Na halide is deposited on the tube walls. The length of the reaction zone is proportional to the cu. root of the reaction velocity. Chemiluminescence (D line) was caused by mixts. of Na with Cl₂, Br₂, I₂, HCl, HgCl₂, HgI₂, CdCl₂, CdI₂, PCl₃ and Hg(CN)₂; no emission occurred with TiCl₄, TlI or AlCl₃, or with any org. halogen compd. From the reaction velocity it is calcd. that one collision in a hundred leads to a reaction [only for HCl noticeably less (1 in 10⁴)]. In the case of Na + I₂ a sep. dark zone of 2 cm. with NaI deposit contained the primary reaction Na + I₂ = NaI + I; in a 10-cm. second zone the light-emitting reaction Na + I + Na = NaI + Na + hν took place; the speed of the latter reaction is 100 times smaller than that of the first. From the light intensity (1/100-1/1000 candles) it follows that 1/100 of the total number of combinations Na + I causes emission, i. e., 10⁻⁴ of all the Na-I collisions and is yet 10⁴ times more than can be expected from the normal gas kinetics for triple collisions (0.03 mm. Na pressure). Detailed discussion of these points will follow in *Z. Physik*.

Formation of organic from inorganic compounds under the influence of light. OSKAR BAUDISCH. *Chem.-Ztg.* **49**, 737 (1925).—Dilute aq. solns. of KNO₃ contg. formaldehyde or MeOH react under the influence of ultra-violet light to produce formhydrox-

amic acid $\text{HC}(=\text{NOH})\text{OH}$. The acid forms an insol. Cu salt as well as yielding a brilliantly colored reddish violet inner complex with FeCl_3 . By means of this color reaction it was possible to detect the formation of the acid in illuminated solns. of KNO_3 contg. CO_2 and also in the reaction between CO_2 and NO in aq. soln. under the influence of mountain sunlight at Monte Rosa (4560 m. above sea level). The latter expt. was repeated in the laboratory using a Hg lamp, with success. The author calls attention to the fact that most of this work was performed in the years 1911-3 (cf. *C. A.* 5, 2826; 6, 2448, 2622; 8, 152,951). Recently the work was repeated by Baly and Heilbron, who ascribe great importance to the formation of the formhydroxamic acid in the assimilation of CO_2 by plants. Fe ions and other catalysts accelerate the light reaction.

F. C. KRACEK

Mechanism of the photochemical reaction between hydrogen and chlorine. A. L. MARSHALL. *J. Phys. Chem.* 29, 842-52(1925).—Expts. on the interaction between Cl_2 and at. H produced in a discharge tube at various low pressures yield values from 1 mol. HCl per 1 atom H at 0.004 cm. pressure to 7 mols. HCl per at. H at 0.60 cm. pressure. These results considered in light of recent literature seem to oppose Nernst's mechanism for the reaction; a mechanism involving excited Cl_2 mols., proposed originally by Bodenstein (*C. A.* 11, 1592) seems the more probable. The latter involves the following steps: $\text{H} + \text{Cl}_2 = \text{HCl}' + \text{Cl}$, $\text{HCl}' + \text{Cl}_2 = \text{Cl}_2' + \text{HCl}$, $\text{Cl}_2' + \text{H}_2 = 2\text{HCl}$, $\text{Cl} + \text{Cl} = \text{Cl}_2$.

F. C. KRACEK

Life period of activated molecules in thermal and photochemical reactions. N. R. DHAR AND B. K. MUKERJI. *Z. Elektrochem.* 31, 283-5(1925).—The equation of Turner (*C. A.* 18, 1947), used for the evaluation of the period of life of Hg atoms from the expts of Frank and Cario, has now been applied to the results of several reactions of gases or dil. solns. Both for thermal and for photochem. reactions it was found that the av. time of activation of the mols. was of the order 10^{-7} to 10^{-8} sec. This may be considered as evidence in favor of the radiation hypothesis for chem. reactions. B. J. C. v. D. H.

Polarized fluorescence and phosphorescence of solutions of dyes. V. L. LEVSHIN. *Z. Physik* 32, 307-26(1925).—A theoretical paper in which L. attempts to account for the polarized fluorescence of dyestuff solns., in terms of the assumption that these substances represent elec. dipoles which are rotating in all directions as a result of the heat motions. To arrive at the equations he assumes that absorption and emission take place instantaneously, but that between absorption and emission the atoms remain in an activated state for T seconds. He arrives at an expression for the percentage polarization in terms of an av. angle of rotation during the time T . Taking into account the distribution of angles of rotation among the mols. he calcs. the polarization in % as a function of the sq. root of the mean squared angular rotation. From the Brownian movement equation for rotational motion this av. angular displacement is given in terms of the duration T/a^2 , where a is the radius of the mol. Using measured values of the percentage polarization for different dyestuffs rough values for T/a^2 and T are computed. He carries his computations over to the case of the fluorescence in solids where the motion of the dipole is restricted and periodic; the equation is then discussed on the basis of Pringsheim's measurements on polarization of phosphorescent light. The equations are then generalized to take account of both oscillation and rotation of the dipole. Finally the influence of viscosity and concn. on the percentage of polarization of different types of dyestuffs in soln. is discussed in the light of this theory. The paper should serve as a useful guide for further investigations along these lines. H. B. L.

Budde effect in bromine. E. B. LUDLAM. *Proc. Roy. Soc. Edin.* 44, 197-201 (1924).—Ordinary pure Br vapor when illuminated showed an immediate rise in temp. with corresponding vol. change. Purified Br contg. no water vapor showed no Budde effect under various conditions of illumination. It is suggested that, as proposed by Perrin (*C. A.* 13, 3067), pure Br radiates in all directions the energy which it absorbs, but that traces of water vapor have a catalytic effect on the dissociation into atoms, which on recombining effect an increase in temp. with an appropriate vol. change.

B. C. A.

The scattering of radiation by atoms. H. A. KRAMERS AND W. HEISENBERG. *Z. Physik* 31, 681-708(1925).—If monochromatic light falls on an atom it emits not only secondary spherical waves of the same frequency, but also the correspondence principle demands that in general waves of other frequency, as well must be emitted. These frequencies are all of the form $V = V^*$ where V^* is the energy difference between the atoms in the state considered and in any other state. The paper shows how a theoretical treatment of the scattering action of an atom by means of the correspondence principle follows uniquely and naturally on the basis of the wave theory. The theoretical treatments really constitute extensions of the conceptions of the relation between the

wave radiation of the atom and the stationary states which are represented in a well-known paper of Bohr, Kramers and Slater. If the conclusions following from these considerations prove to be correct they should furnish valuable proof of the correctness of the assumptions in the above-mentioned paper. L. B. LOEB

Total radiation of platinum. W. GRIS. *Physica* 5, 203-7(1925).—The total radiation of a pure Pt wire *in vacuo* between 200° and 1300° can be expressed by $S = \epsilon \times sT^4 = \gamma T^2 \cdot sT^4$ wat/sq. cm. (s is the Stefan-Boltzmann const.), in which γ was found to be 0.22×10^{-4} ; $\varphi = 0.767$ independently of temp. B. J. C. v. D. HOEVEN

Periodic classification of the elements from the point of view of the study of isotopes (SHCHUKAREV) 2. Eka-manganese (NODDACK, TACKE) 2. The theory of reaction rate (LEWIS, SMITH) 2. Chlorine hexoxide (BODENSTEIN, *et. al*) 6.

CRANSTON, J. A.: *The Structure of Matter*. New York: D. Van Nostrand Co. 196 pp. \$4.50. Reviewed in *J. Phys. Chem.* 29, 1190(1925).

4¹ ELECTROCHEMISTRY

COLIN G. FINK

A high-frequency induction furnace plant for the manufacture of special alloys. P. H. BRACE. *J. Am. Inst. Elec. Eng.* 44, 992-1000(1925).—The Westinghouse Co. is commercially producing metals and alloys of high purity. The plant equipment is described in detail under 3 headings: (1) *The electrolytic Fe refinery*.—The electrolyte of $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ and $(\text{NH}_4)_2\text{SO}_4$ has concns. of Fe 53.1; Cl 26.8, SO_4 113.5; and NH_4 31.3 (g./l.). There are 18 wooden tanks each contg. 10 anodes (Armco iron) and 9 cathodes (sheet steel). The output is 700 lb./hr.; c. d. 10-12 amp/sq. ft.; v. 20 max. (2) *The high-frequency power plant*.—The induction furnaces are supplied with high-frequency power from a specially designed motor-generator set. A frequency of about 5000 cycles per sec. is obtained from the alternator which is connected in series with the furnace, the inductor coil and the bank of condensers; it delivers 400 amp. at 250-300 v. (3) *The high-frequency furnace plant*.—The furnaces operate on the same principle as those developed by E. F. Northrup. The method of calcg. the elec. characteristics of a given combination of inductor and charge is given in detail. In the 2 types of furnaces the melting chamber consists of 2 crucibles, one inverted over the other. One (of 50 lb. capacity) is a vacuum furnace and the other (of 225 lb. capacity) is designed for use with H as reducing agent. Zr silicate is used for thermal insulation and, when bonded with clay, for linings and crucibles. A production cost analysis, based on a monthly output of 30,000 lb., indicates 16.55¢ per lb. for electrolytic Fe and 36.62¢ for Fe-Ni alloy. A. D. SPILLMAN

Studies on electroplating. VI. Barrel-plating (1) advantages and disadvantages of barrel-plating and some principal features of plating barrels. W. E. HUGHES. *Metal Ind.* (London) 27, 95-6, 121-2, 128(1925); cf. *C. A.* 19, 2456.—The material of construction, shape and size, ease of handling and unloading of the plating barrel, the inspection of work during plating, the cathode contacts, immersion and movement of the work, and the renewal of the electrolyte are discussed. "No plating barrel is a really good one that is not so adjusted when rotating, that the whole of the work remains continuously submerged." W. H. BOYNTON

Electrolytic surfacing of hard metallic objects. M. PIRANI* AND K. SCHRÖTER. *Z. Metallkunde* 16, 132-3(1924).—A method is devised to surface electrolytically such materials as tungsten carbide, tool steels, draw plates, etc., which can be worked only with great difficulty. The material to be surfaced is made the anode, placed in a funnel and immersed to the required depth into an insulating liquid ($\text{C}_2\text{H}_5\text{Cl}$). The latter is covered with a soln. of NaOH into which the cathode is suspended. On passing a current through the system the etching of the anodic material continues until its surface is flush with the level of the insulating liquid. Smooth surfaces are thus obtained. Holes are made by loosely placing a glass capillary contg. the cathode on to the surface of the material to be perforated. Upon closing the circuit the capillary gradually sinks into the cavity due to localized anodic corrosion. H. S. VAN KLOOSTER

Electric heat used for battery compound. F. W. MCGRAW. *Elec. World* 86, 468(1925).—Because battery compds. have a low sp. heat and an unchanging sp. gr. a uniform heating medium is necessary. Gas and other fuels were found unsatisfactory because of fire hazard and difficulty of control. Elec. space heaters, thermostatically

controlled, applied to the sides and bottom of tank and to the tubes were found very effective. The time for sealing was reduced to $1/4$ of that for the hand ladle method.

A. D. SPILLMAN

The starting of direct and alternating-current tungsten arc lamps by means of alternating current. H. EWEST AND A. RÜTTENAUER. *Z. tech. Physik* 6, 327-9 (1925).

J. H. PERRY

Temperature fluctuations in wires charged with alternating current and their effect on vaporization and recrystallization. H. PLAUT. *Z. tech. Physik* 6, 313-7 (1925).—The temp. fluctuations due to the fluctuating heating current occurring in a. c. charged wires have been calcd. It is shown that certain hitherto inexplicable differences exist in the behavior of d. c. and a. c. and these differences are traced to the vaporization and recrystn. of the wires.

J. H. PERRY

The nature of corona loss. C. T. HESSELMAYER AND J. K. KOSTKO. *J. Am. Inst. Elec. Eng.* 44, 1068-75 (1925).

C. G. F.

Electric gas purification. GEORG SCHAPRINGER. *Montan. Rundschau* 17, 592-5 (1925).—A review with brief discussion of the application to the blast furnace, to industrial firing, the grinding industries, cement and magnesite industries, H_2SO_4 manuf. and cellulose manuf.

E. H.

The life period and the vaporization of tungsten. R. BECKER. *Z. tech. Physik* 6, 309-13 (1925).—It is shown that both of the age phenomena of incandescent lamps, i. e., the light decrease and the burning through of the wire, are essentially detd. by the vaporization of the W. While the decrease of light for each individual lamp is directly connected with the regular vaporization, the limit of the life period is a question of defective spots in the wire, since a lamp supplied with a completely uniform wire must last infinitely long.

J. H. PERRY

The manufacture and repair of electric accumulators. C. W. PRICE AND J. C. BRIDGE. *J. Ind. Hyg* 7, 451-74 (1925).—Lead poisoning in this industry, is discussed.

E. H.

The manufacture of carborundum at the "Poroguy" electrometallurgical plant. S. S. STEINBERG. *Messageur ind. métaux russes* Nos. 4-8, 133-41 (April-Aug., 1923); *Rev. metal.* 22 (Extraits) 349-50 (1925).—With a 3 x 1.5 x 1 m furnace, a 470 x 450 mm. core, and a charge of charcoal 75, quartz 93, sawdust 18.5, NaCl 12.75 pounds, there was obtained 20-25 pounds of carborundum in 15-8 hrs. with a consumption of 6000-7000 kw. hrs.

A. PAPINEAU-COUTURE

The appearance of the Tyndall phenomena in gas-filled W lamps (ALTERTHUM, BECKER) 2. Chemico-physical investigations on the catholyte of diaphragm electrolyzers with circulation of NaCl (GIORDANI) 2. Behavior of diaphragm electrolyzers with circulation of the alkali chloride (GIORDANI) 2. Magnetic properties of cast Fe (O'NEILL) 9.

Electric batteries. SOC. ANON. LE CARBONE. *Brit.* 230,307, April 10, 1924. Highly porous electrodes of gas batteries or accumulators are provided with a coating such as a peized colloid which is impermeable to liquids but permeable to gases. Examples are given. Cf. C. A. 18, 1089.

Electric batteries and battery connections. H. GEBHARDT and F. ELECTROCHEMIE AKR.-GES. *Brit.* 230,377, Sept. 27, 1924. Structural features.

Dry batteries. C. P. DEIBEL AND W. G. WAITT. U. S. 1,552,395 Sept. 1. Mech. features.

Dry batteries. C. P. DEIBEL. U. S. 1,552,396, Sept. 1. Structural features.

Active material of storage batteries. J. O. LUTHY. *Brit.* 230,058 Feb. 28, 1924.

The filling of old storage battery grids is sepd. from the grids and formed into a paste with an aq. soln. of HOAc or similar acid for reuse on new grids.

Cylindrical electrodes for storage batteries. H. F. JOEL. *Brit.* 230,184, Dec. 6, 1923. Structural features.

Cathodes for electron discharge tubes. C. J. KAYKO. U. S. 1,552,310, Sept. 1. $BaCO_3$ or similar "difficultly vaporizable compd. of a highly positive metal" is mixed with cathode material such as Ni and a binder in finely divided state and the materials are formed at a temp. below the point of volatilization.

Electrical precipitation of suspended particles from gases. E. ANDERSON. U. S. 1,551,724, Sept. 1. Mech. features.

Electrical resistance furnace. E. F. NORTHRUP. U. S. 1,551,766, Sept. 1.

Electric resistance crucible furnace. H. L. NASH. U. S. 1,551,830, Sept. 1.

Tilting electric furnace. J. H. GRAY. U. S. 1,552,142, Sept. 1.

Apparatus for the electrodeposition of precious metals from ores. W. R. DORGE. Can. 250,855, June 23, 1925.

Recovering metals from tin plate. Q. MORINO. Can. 250,691, June 16, 1925. Tin plate is immersed in a bath of an alk. dichromate, and MnO_2 in HCl , and heated to 70° to 90° to dissolve the Sn, which is pptd. by electrolysis.

Zinc recovery. H. W. GEPP. Can. 251,250, June 30, 1925. A ZnSO_4 soln. is subjected to the action of an elec. current in cells having Pb anodes and cathodes consisting of an alloy of Al and Si which contains 5–15% of Si.

Metal foil. C. MÜLLER. Brit. 230,456, March 4, 1924. Foil of Ni or other metal is deposited electrolytically on a temporary backing or support of Cu or other more easily sol. metal which may afterward be dissolved. Numerous details are given as to methods of forming and mounting foils of different metals.

Tungsten powder. A. DE GRAAFF. U. S. 1,552,122, Sept. 1. W powder for manuf. of filaments, etc., is prepd. by forming silicotungstic acid, e. g., by reaction of Na tungstate, HCl and Na silicate, removing by-products of the reaction, e. g., by washing and crystn., pulverizing the product and reducing it with H to obtain W contg. SiO_2 . This product forms wire of uniform crystn.

'5 PHOTOGRAPHY

C. E. K. MEES

Photographic ripening process. LUPPO-CRAMER. Z. wiss. Phot. 23, 137–44 (1925); J. Chem. Soc. 128, 11, 574; cf. C. A. 19, 1230.—The ripening of emulsions is inhibited by the gelatin itself, which acts as a protective colloid for AgBr grains, and by acid and basic dyes. Thus NH_3 has little or no action when dyes such as erythrosin, rhodamine, pinachrome and pinacanol are incorporated in the emulsion. These effects, and the well-known resistance to fog exhibited by emulsions contg. AgCl in addn. to the AgBr, are apparently dependent on the order of adding the various constituents. Directions are given for the prepn. of certain sp. emulsions. The conditions affecting the quant. adsorption of Ag^+ by AgBr are considered relevant in interpreting the action of oxidizing agents in desensitizing emulsions. A critical amt. of Ag^+ adsorbed to AgBr stabilizes the emulsion against the attack of oxidizer.

H. R. MOORE

Effect of developer concentration on the contrast of the developed image. L. LOBE. Photo-Rev. 36, No. 24, 1–2 (1924); Chemie et industrie 14, 253 (1925).—When identical negatives are developed in solns. contg. different quantities of pyrogallie acid, the developer contg. most reducer gives the most contrasty image, and the character, i. e., curve extends farther so that there is a greater possible range of time of exposure. The quantities of light corresponding to overexposure with the weaker developer lie in the normal exposure portion of the curve for the stronger developer. Other developers give similar results, but to varying degrees, e. g., in genol hydroquinone developers, excess of hydroquinone accentuates this phenomenon more than excess of genol. In order to have max. latitude for overexposure it is advisable to use a developer giving strong contrast, correcting the hardness of the negative, if desired, by using a non-contrasty paper.

A. PAPINEAU-COUTURE

Application of the Ostwald chrommeter to color development (MILBAUER, LAUSCHMANN) 2.

Color cinematography. L. LÆYDE. Brit. 230,387, Oct. 14, 1924. A method is specified of making and projecting (with colored lights) different images taken through complementary red and green color screens.

Color photography. G. OLLENDORFF and A. TANZEN. U. S. 1,551,611, Sept. 1. Color value positives are photographed, each being illuminated by monochromatic light corresponding to it, upon a polychromatic screen provided on its opposite side with a sensitive emulsion.

Polychrome screens for color photography. L. DUFAY. U. S. 1,552,126, Sept. 1. One face of a transparent support is coated with a primary color, greasy reserves are applied to the colored surface, the primary color is removed from the parts not coated with greasy reserves, another primary color is applied to the stripped parts and the reserves are then removed to obtain a 2-color screen.

—INORGANIC CHEMISTRY

A. R. MIDDLETON

Systematic affinity principle. XXXI. Thiohydrides. WILHELM BILTZ AND Z. *anorg. allgem. Chem.* **147**, 171-87 (1925); cf. C. A. **19**, 945.—Water-free, liquid H_2S at about -78.5° does not react with or dissolve BeCl_2 , HgCl_2 , CaCl_2 , CoCl_2 , NiCl_2 , SbCl_3 , VCl_4 , LaCl_3 , ThCl_4 , TiI_4 , SnBr_4 , SnI_4 , ZrCl_4 , In_2S_3 , As_2S_3 , H_2O . SO_2 dissolves slightly with a green color (S_2O_3). CCl_4 , CBr_4 , SiCl_4 , PCl_3 , CS_2 and SO_2 were dissolved without discontinuities in the isothermal vaporization curve. Thiohydrolysis occurred for AsCl_3 , PCl_5 , SbCl_5 , S_2Cl_2 . PbCl_4 was reduced to PbCl_2 . The following data were obtained for thiohydrides: $\text{AlCl}_3 \cdot \text{H}_2\text{S}$ 9.22 cal. (heat of formation per mole H_2S from next lower thiohydrate at zero degrees), $+14^\circ$ (decompn. temp. for $p_{\text{H}_2\text{S}} = 100$ mm.); $\text{AlBr}_3 \cdot \text{H}_2\text{S}$ 9.72 cal., $+30^\circ$; $\text{AlI}_3 \cdot 2\text{H}_2\text{S}$ 9.13 cal., $+11^\circ$, 9.13 cal. (total heat of formation from gaseous H_2S + halide); $\text{AlI}_3 \cdot 4\text{H}_2\text{S}$ 6.30 cal., -79° , 7.71 cal.; $\text{BeBr}_2 \cdot 2\text{H}_2\text{S}$ 8.85 cal., $+1^\circ$; $\text{BeI}_2 \cdot 2\text{H}_2\text{S}$ 6.15 cal., -83° ; $\text{TiCl}_4 \cdot \text{H}_2\text{S}$ 8.86 cal., $+2^\circ$, 8.86 cal.; $\text{TiCl}_4 \cdot 2\text{H}_2\text{S}$ 7.20 cal., -41.5° , 8.18 cal.; $\text{TiBr}_4 \cdot \text{H}_2\text{S}$ 8.56 cal., -7.5° , 8.56 cal.; $\text{TiBr}_4 \cdot 2\text{H}_2\text{S}$ 7.20 cal., -50.5° , 7.88 cal.; $\text{SnCl}_4 \cdot 2\text{H}_2\text{S}$ 6.98 cal., -98° , 6.98 cal.; $\text{SnCl}_4 \cdot 4\text{H}_2\text{S}$ 6.21 cal., -81° , 6.60 cal. The calorific data are calcd. from the vapor tension curve. Crystal formation was not observed; the Ti salts changed in color, $\text{TiCl}_4 \cdot \text{H}_2\text{S}$ is sublimable into small yellow crystals. In $\text{AlCl}_3 \cdot \text{H}_2\text{S}$ $d_{-30^\circ} = 2.162$ and in $\text{TiCl}_4 \cdot \text{H}_2\text{S}$ $d_{-30^\circ} = 1.721$ (for TiCl_4 $d_{-30^\circ} = 1.781$), the mol. vol. of H_2S is 23 to 24 cc. (calcd. 25 cc., cf. Z. *anorg. allgem. Chem.* **119**, 221 (1921)). The theory recently given (C. A. **19**, 2591) is in agreement with the data. It appears that high-melting substances, insol. in liquid chlorine, good conductors (ionic lattices) do not dissolve in or combine with H_2S . Chlorides which do form thiohydrides are low-melting insulators (molecular lattices); HgCl_2 and ZnCl_2 are boundary cases. Experimental details are given for the prepn. of TiBr_4 (m. 39° , b.₅₇ 230°); TiI_4 and VCl_4 (m. -109° , b.₇₅₅ 148.5°).

B. J. C. VAN DER KOOVEN

Preparation of intermetallic compounds by the wet method. A. MAZZUCHELLI AND A. VERCILLO. *Atti accad. Lincei [VI]* **1**, 233-5 (1925); cf. C. A. **18**, 2289.—A 35% soln. of SbCl_3 in dil. HCl (1:1) is practically inert towards Cu at the ordinary temp., but at 100° deposits on it a thin, adherent, metallic film, which stops further action. If, however, the liquid contains a considerable amt. of CuCl , the action at 100° becomes continuous and leads to the formation of the compd., Cu_3Sb . Under similar conditions, treatment of Sn with a mixt. of CuCl and SnCl_2 yields an alloy with $\text{Sn}:\text{Cu} = 1:6$, possibly consisting of the compd. Cu_3Sn covered with granules of Cu ; SbCl_3 and Sn give the alloy Sb_2Sn ; AsCl_3 and Cu , the compd. As_2Cu_3 ; telluric chloride and Cu , a compd. having the compn. Te_3Cu_2 , but consisting probably of a mixt. of Te_2Cu or TeCu_2 with Te ; Te chloride and Pb give, not the compd. PbTe , but pure Te . Neither Bi chloride and Sb nor Sb chloride and Bi yield Sb-Bi alloys. The results obtained are discussed in relation to the considerations advanced by Mylius and Fromm (*Ber.* **27**, 630-51).

B. C. A.

New compounds of nickel and copper with diacetyldioxime. FRITZ PANETH AND ERICH THILO. Z. *anorg. allgem. Chem.* **147**, 196-216 (1925).—The object of this study was to find why the properties of nickel dimethylglyoxime, DHNiHD , are so far different from those of similar compds. of other metals. $(\text{DH}_2\text{NiH}_2\text{D})\text{Cl}_2$ (I), analogous to a Co compd. of Feigl and Rubinstein (C. A. **18**, 64), was prepd. by leading dry HCl over dry DHNiHD ; it is a blue-gray powder, stable up to 100° in dry air, decomposed by EtOH , H_2O , NH_3 and concd. acids, insol. in ether, sol. in dry acetone, MeEtCO and AcOEt . Other ways of prepn. are HCl gas in ether suspension of $\text{Ni}(\text{DH})_2$, boiling of acetone NiCl_2 soln. with excess DH_2 . I is obtained in dark blue crystals by evapn. to dryness of the acetone mother liquor from prepn. of I. The compd. $(\text{DH}_2\text{NiH}_2\text{O})\text{Cl}_2$ (II) was prepd. by reflux boiling of 4 g. I in 250 g. "dry" acetone as bright green crystals, stable up to 133° , decomposed by EtOH , H_2O , AcOH and alkalis, insol. in or decomposed by org. solvents. The constitution is not entirely clear because of lack of a proper solvent. It can also be prepd. by boiling NiCl_2 with DH_2 in acetone soln., and is then contaminated by $\text{Ni}(\text{DH})_2$. Heating of II *in vacuo* over P_2O_5 between 118° and 130° causes a loss of 7.44% in wt., and gives yellow-green or brown DH_2NiCl_2 (III), decomposed like II, sol. in dil. HCl or HNO_3 , insol. in org. solvents, hydrated to II by boiling with "dry" acetone. Dry NH_3 gas over I in either form yields red powdered $\text{Ni}(\text{DH})_2$; over II it gives a dark carmine red substance (IV), either $\text{DNI}(\text{NH}_3)_2$ or $(\text{DH}_2\text{Ni}(\text{NH}_3)_4)\text{Cl}_2$ with evolution of water vapor; it is insol. in all solvents, stable in air, decomposed by acids and by ice-cold water. IV added to boiling water gives dark red crystals of

probable compn. $\text{Dn}(\text{OH})_2$ (V). $(\text{DH}_2\text{Cr})\text{Cl}_2$ (VI) a dark blue-green crystalline substance is obtained by adding 1CuCl_2 to 1DH_2 in acetone or alc. soln., also by adding HCl to an acetone $\text{Cu}(\text{DH})_2$ soln. Dry HCl over $\text{Cu}(\text{DH})_2$ yields VI very slowly. VI is stable, in air, decomposed by excess water, sol. in EtOH and acetone, insol. in ether and MeCN .

B. J. C. VAN DER HOEVEN

A new series of organic compounds of tin. The stannonic acids and some of their derivatives. J. G. F. DRÜCK. *Rec. trav. chim.* 44, 340-4 (1925).—Alkyl halides react with KHSnO_2 or NaHSnO_2 giving the alkali salt of the alkylstannonic acid (I) thus: $\text{MeI} + \text{KHSnO}_2 + \text{KOH} \rightarrow \text{MeSnO}(\text{OK}) + \text{KI} + \text{H}_2\text{O}$. The free stannonic acid may be liberated with CO_2 . In this way methyl-, ethyl-, propyl- and isopropylstannonic acids have been prepd. They are infusible, amorphous solids, insol. in H_2O and most org. solvents. On heating in air they ignite and leave a residue of SnO_2 . When heated in the absence of air they decomp. in 3 ways. $\text{C}_3\text{H}_7\text{SnO}_2\text{H}$ decomp. thus: (1) $\text{PrOH} + \text{SnO}$; (2) $\text{C}_3\text{H}_8 + \text{SnO} + \text{H}_2\text{O}$; (3) $\text{C}_3\text{H}_8 + \text{SnO}_2$. These acids not only form alkali salts but also dissolve in halogen hydroacids forming tin alkyltrihalides, thus $\text{EtSnO}_2\text{H} + 3\text{HBr} \rightarrow \text{EtSnBr}_3 + 2\text{H}_2\text{O}$. The reaction by which I is obtained is not quant. Other reactions occur to some extent. A white ppt. is sometimes formed thus: $2\text{EtI} + 2\text{KHSnO}_2 + 2\text{KOH} \rightarrow \text{Et}_2\text{SnO} + \text{K}_2\text{SnO}_3 + 2\text{KI} + 2\text{H}_2\text{O}$. These compds. may be called "stannonnes" to indicate their analogy with the ketones and are also formed by heating the alkali salts: $2\text{MeSnO}_2\text{K} \rightarrow \text{Me}_2\text{SnO} + \text{K}_2\text{SnO}_3$. These stannonnes are white, infusible, amorphous solids that are unlike the ketones in their general properties. The formation of trialkyl tin hydroxides is also a side-reaction: $3\text{RI} + 3\text{KHSnO}_2 + 4\text{KOH} \rightarrow \text{R}_3\text{SnOH} + 2\text{K}_2\text{SnO}_3 + 3\text{KI} + 3\text{H}_2\text{O}$. These compds. are sol. in H_2O , have an odor like that of putrefying onions and are extd. with any immiscible org. solvent. R_3SnO dissolves in HCl and HBr to form dialkyl tin dihalides, R_2SnX_2 . These compds. and R_2SnX_2 combine with HCl or HBr salts of org. bases giving pyridine methylchlorostannate, $(\text{C}_5\text{H}_5\text{N})_2\text{H}_2(\text{Me})\text{SnCl}_6$, etc. R_3SnCN , $\text{R}_2\text{Sn}(\text{CN})_2$ and $\text{RSn}(\text{CN})_3$ are prepd. by the action AgCN on the corresponding halogen deriv. in abs. EtOH soln. The reaction takes place in a few days and the alkyl tin cyanide can then be crystd. from the filtrate from AgX . Unsuccessful attempts were made to obtain $\text{R}_3\text{SnCO}_2\text{H}$, $\text{R}_2\text{Sn}(\text{CO}_2\text{H})_2$, $\text{RSn}(\text{CO}_2\text{H})_3$ by sapon. of the cyanides. Generally they react thus: $\text{Et}_2\text{Sn}(\text{CN})_2 + \text{H}_2\text{O} \rightarrow \text{Et}_2\text{SnO} + 2\text{HCN}$. However, $\text{Pr}_2\text{Sn}(\text{CN})_2 + 4\text{H}_2\text{O} \rightarrow \text{Pr}_2\text{Sn}(\text{CO}_2\text{H})_2 + 2\text{NH}_3$. This dibasic acid has not been isolated in the pure state for analysis.

L. J. WITZEMANN

Hydrogen magnesium halides. R. M. PICKENS. *Science* 62, 226 (1925).—Catalytic reduction of Ph_2MgCl gave results which are indicative of the formation of HMgCl .

L. W. RIGGS

Chlorine hexoxide. MAX BODENSTEIN, PAUL HARTECK, EMANUEL PADELT. *Z. anorg. allgem. Chem.* 147, 233-44 (1925).—On exposing ClO_2 to light (8-9°) deep red drops of Cl_2O_6 appear on the glass walls (detd. by elementary analysis and m. p. lowering of CCl_4 with 1 mm. vapor pressure; it can easily be purified by distn. Its m. p. is -1° ; it has an orange-red color, $d_{20} = 1.65 \pm 0.05$, reacts violently with water giving HClO_3 and HClO_4 (observed losses are due to HClO_3 decompn.), ignites wood, alc. (even at -78°), decomposes slowly at room temp. and is highly explosive when mixed with other chlorine oxides. The same substance has been described (Cl_2O_{17}) by Millon (*Ann.* 45, 281 (1843)) and was observed by Bowen (*C. A.* 18, 22). It is also formed by illumination of a mixt. of Cl_2 and O_3 (at least 20% at atm. pressure) with red light (620 $\mu\mu$), which activates the ozone; not by blue light, which causes Cl activation and resultant ozone decompn.

B. J. C. VAN DER HOEVEN

Potassium chloriminosulfonate. F. RASCHIG. *Z. anorg. allgem. Chem.* 147, 1-4 (1925).—K iminosulfonate with NaOCl soln. gave K chloriminosulfonate, $\text{ClN}(\text{SO}_3\text{K})_2$. This with KI soln. liberated I_2 . On standing in a desiccator it decompd. gradually with evolution of NCl_3 . When decompd. in a CO_2 stream at 180° , it lost all its Cl and about $1/3$ of its N as elements, leaving K nitrosulfonate, $\text{N}(\text{SO}_3\text{K})_2$. This on boiling with H_2O gave $2\text{KHSO}_4 + \text{H}_2\text{NSO}_3\text{K}$. The mechanism of these reactions is explained.

A. W. FRANCIS

Ammonocarbonic acids and their reactions in liquid ammonia. W. L. BURDICK. *J. Am. Chem. Soc.* 47, 1485-90 (1925).—With the purpose of completing this series of acids the prepn. of dicyanamide, tricyanomeamine, hydromelonic acid and carbon nitride was undertaken. Na dicyanamide prepd. in aq. soln. (Madelung and Kern, *C. A.* 16, 2114) was purified by recrystn. from liquid NH_3 . The Ag salt was decompd. by H_2S and the acid evapd. at low pressure. Analysis of the white needles indicated $\text{HC}_2\text{N}_2\cdot\text{H}_2\text{O}$. The mercuric salt, pptd. by adding $\text{Hg}(\text{NO}_3)_2$ to the aq. soln. of the Na salt, puffs up at 110° like $\text{Hg}(\text{SCN})_2$. Tricyanomeamine, $\text{H}_3\text{C}_6\text{N}_9\cdot 3\text{H}_2\text{O}$, was prepd. by

action of H_2S on the Ag salt in aq. suspension and evapg. in vacuum. The Na salt was prepd. by fusion of dicyanodiamide and Na cyanamide and extrn. with boiling water. The trihydrate seps. from the cooled soln. in white needles. By double decompn. in liquid NH_3 were prepd. the Ag salt (3NH_3), Cu salt (12NH_3) and Pb salt (6NH_3). Aq. soln. of Na melonate with AgNO_3 and action of H_2S on the gelatinous Ag salt in aq. suspension gave a white powder, indicated to be dihydrate of hydromelonic acid, $\text{H}_3\text{C}_9\text{N}_{13}\cdot 2\text{H}_2\text{O}$. The Na salt was prepd. by adding slowly melted SiCl_4 to fused NaSCN , extrn. with hot water and removal of sulfides by $\text{Pb}(\text{OH})_2$. Recrystn. from hot solns. gave $\text{Na}_3\text{C}_9\text{N}_{13}\cdot 5\text{H}_2\text{O}$. Double decompn. in liquid NH_3 gave $\text{Ag}_3\text{C}_9\text{N}_{13}\cdot 6\text{NH}_3$. A. R. M.

Correction to a paper on aluminium sulfide. WILHELM BILTZ. *Z. anorg. allgem. Chem.* **146**, 289-90 (1925).—The colorless, needle shaped, cryst. sublimate deposited during vacuum sublimation of Al_2S_3 , as described in an earlier paper (cf. *C. A.* **5**, 30(19), was considered at that time to be Al_2S_3 . Tiede's analyses as well as those of Gölmann have since shown this substance to have been silicon disulfide (SiS_2). R. L. D.

Mercury helide. G. JOOS. *Naturwissenschaften* **13**, 697-8 (1925).—The mercury helide formation reported by Manley (*C. A.* **19**, 1827) may be due to a union of Hg in 2s condition and Hg in 2p., both metastable; this hypothesis agrees with the observed increase in n of the mixt. Also Hg-Ne compds. are possible; they belong in one class of compds. with O_2 , for all of which a glow discharge is essential in the prepn. An estimate is given of the energy content. B. J. C. VAN DER HOEVEN

Bismuth dihydride. E. J. WEEKS AND J. G. F. DRUCE. *J. Chem. Soc.* **127**, 1799-1800 (1925).—If a soln. of BiCl_3 in HCl is added to a mixt. of Zn (free from Fe, C and As) and fairly strong HCl , a gray flocculent ppt. is formed. When dried successively in H_2 and *in vacuo* analysis corresponds to the formula Bi_2H_2 . Heated in the absence of air Bi_2H_2 decomposed into BiH_3 and Bi . Fused KNO_3 reacts vigorously with Bi_2H_2 . M. O. LAMAR

The laboratory preparation of hydrogen sulfide. IGNACIO PUIG. *Quim. e Industria* **2**, 141-4 (1925).—Besides the app. of Hinds and Rattenbury those of Brown and Keenoy (I) and of E. Szaz (II) are described. In I the acid flows from a tubulated bottle placed on a higher level through a U-tube which retains the solid impurities into a vertical tube contg. FeS . The lower end of the latter communicates with recipients for the used acid; the upper end carries the delivery tube. Constricted ends ensure a slow, steady H_2S current. II is similar but more complicated. The acid is used repeatedly after the solid impurities have settled down. MARY JACOBSEN

The action of hydrogen sulfide gas on mercuric salts. H. PÉLABON. *Bull. soc. chim.* **37**, 854-6 (1925).—An acidity of HCl 6H \cdot O is the limit above which H_2S ppts. only the white 2HgS HgCl_2 from solns. of HgCl_2 . Below this limit various proportions of this salt and black HgS are obtained, depending upon the acid concn. and the time of passage of the H_2S . Free HCl is liberated in the reaction, tending to increase the original acidity. P. B. KLAPE

Decomposition of carbonyl chloride by heat. ALFRED STOCK AND WERNER WUSTROW. *Z. anorg. allgem. Chem.* **147**, 245-55 (1925). The reaction $2\text{COCl}_2 = \text{CO}_2 + \text{CCl}_4$ (1) was investigated. According to the highly positive reaction heat of +10,680 cal. (Bodenstein's new value for $\text{C}_{\text{amorphous}} + 2\text{Cl}_2 = \text{CCl}_4(\text{g}) + 24,000$ cal. used), K was calcd. (Nernst) that at 200°K , $K_p \approx 5.77 \times 10^{-6}$, at 800° 3.33×10^{-3} , i. e., a decompn. of 99.9 and 97%, resp. These values are a great deal higher than those practically found for the $\text{COCl}_2 = \text{CO} + \text{Cl}_2$ (2) decompn. Phosgene was heated for several hrs. at 400° or 500° , one atm., with and without catalyzers (Al_2O_3 , AlCl_3 , SiO_2 , C); in the mixt. CO was detd. by freezing out the rest, Cl_2 was absorbed by Hg vapor, CO_2 + HCl detd. from the pressure at -35° . The CCl_4 pressure was detd. after absorption of COCl_2 , CO_2 and HCl in KOH . It appeared that reaction (1) is very slow at these temps.; 0.7% decompn. was found according to (1) after 2 hrs. at 500° , 52% according to (2) and only when new glass tubing was used. Both the reactions are accelerated by catalyzers, (1) particularly by SiO_2 (1.8% decompn., 2 hrs., 500°), and C (1.1%, 4 hrs., 400°). Further discussion of the discrepancy is postponed. B. J. C. v. D. H.

Reducing power of sodium hyposulfite in alcoholic solution. L. EYMER. *Rev. gen. mat. color.* **29**, 96-7 (1925).—If 0.05 g. of $\text{Na}_2\text{S}_2\text{O}_4$ powder is placed in a large dry test tube with 15 cc. of alc., the mixt. heated to boiling and a sample of cotton dyed with indigo is introduced, then 5 cc. of H_2O and the heating is continued, the escape of H_2S is noted, the boiling continues without bumping and the cotton is decolorized. If 0.05 g. of $\text{Na}_2\text{S}_2\text{O}_4$ is dissolved in 5 cc. of water and the dyed cotton is introduced, then 15 cc. of alc. and the mixt. is boiled, the escape of SO_2 is observed, the liquid boils with bumping and the cotton is not decolorized. L. W. RIGGS

The attack of Na_2CO_3 on certain phosphates (COLANI) 7. The formation of N_2H_4 , NH_4OH and PhNH_2 from HN_3 (SCHMIDT) 19. Permutoid structure (KAUTSKY, HERZBERG) 2. Relatively asymmetrical synthesis of the complex salts of heavy metals (LIFSCHITZ) 2.

7—ANALYTICAL CHEMISTRY,

WILLIAM T. HALL

Pure chemicals for research and analysis. A. KLING AND N. SCHOORL. *Compt. rend. cinquième Cong. int. chim., Copenhagen 1924*, 66-90.—Detailed tests are given for ascertaining the purity of certain standard reagents for analysis and research work, together with the following tolerances for impurities: *Hydrochloric acid*: non-volatile matter, 1 mg. per 100 cc.; Fe 0.1 mg. per 100 cc.; As 0.04 pt. per million; free from sulfates, free Cl and heavy metals. *Sodium chloride*: less than 0.1% of volatile matter; free from bromide, iodide and sulfate and from salts of NH_4 , K, Fe, heavy metals and the alk. carbois. *Zinc*: no As mirror should be obtained from 10 g. after treatment for 30 min. with acid free from As; it should also be free from S, P and substances which reduce permanganate when the metal is dissolved in HCl. *Potassium and sodium hydroxide*: less than 2.5% of carbonate, 0.01% of Cl, 0.005% of SiO₂, 0.002% Fe, 0.02% SiO₂ + Al₂O₃, 0.001% N. *Potassium hydroxide* should contain at least 85% KOH and sodium hydroxide 95% NaOH. *Sodium carbonate* crystals should contain 99.8% $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ and less than half the impurities in the hydroxide. *Sodium oxalate*: less than 0.01% of water, 0.01% of insol. matter, 0.002% Cl, 0.001% SO₄, 0.001% Fe; upper limit of alk., not more than corresponds to 0.021% Na_2CO_3 ; upper limit of acidity, less than 0.022% NaHCO_3 . *Ammonia* soln. in paraffin bottles: less than 0.005% of non-volatile matter, 0.0003% CO₂, 0.00005% Cl, and only traces of pyridine. *Iodine*: at least 99.9% I, less than 0.03% of non-volatile matter, only traces of Cl and Br, and no cyanogen. *Potassium dichromate*: free from sulfates, Ca, Fe and Na salts and less than 0.003% Cl. *Nitric acid*: d (min.) 1.38 (50% HNO_3), free from iodate, not more than 0.004% of non-volatile matter, 0.00007% Cl, 0.0006% SO₄, 0.0002% As. *Sulfuric acid*: min 93% H_2SO_4 ; max 0.0005% of non-volatile matter, 0.00005% Cl, 0.0002% NO₃, 0.0005% NH₄, 0.000003% As. *Hydrofluoric acid*: d. 1.14 (37.5% HF), less than 0.005% of non-volatile matter, 0.0005% Cl, and 0.001% SO₂. B. C. A.

New potentiometric methods of titration. F. ZINTL AND A. RAUCH. *Z. Elektrochem.* 31, 428-30(1925). In hot HCl solns. Cu is reduced quant. to the univalent condition by the action of TiCl_3 soln. in an atm. of CO₂. Fe in the tervalent state can, like Cu, be titrated with TiCl_3 and the end point detd. electrometrically. Bi is reduced to metal by similar treatment and there is a sharp e. m. f. change when the reduction is complete. Fe or Cu can be titrated electrometrically in the presence of Bi in dil. HCl. The first potential jump takes place when the Cu or Fe is reduced completely to the *ous* condition and another break indicates Bi. For the Bi titration an empirical correction must be applied or the results will be 0.6% too high. Similarly Au in the tervalent state can be reduced to metallic Au by TiCl_3 in hot HCl soln. and the end point can be detd. electrometrically. W. T. H.

The use of liquid amalgams in volumetric analysis. II. Oxidimetric estimation of tungsten, etc., by using lead and bismuth amalgams. KINICHI SOMEYA. *Sci. Repts. Tohoku Imp. Univ.* 14, 235-49(1925) (in English).—See C. 11, 19, 2614.

W. T. H.

The keeping quality of thiosulfate solutions. J. DAVIDSOHN. *Seifensieder Ztg.* 52, 639-40(1925).—D. kept variously prepd. approx. 0.1 N $\text{Na}_2\text{S}_2\text{O}_3$ solns. for 98 days and observed a decrease in strength in each soln. and a still greater decrease after 250 days in solns. slightly less than 0.1 N in strength. D. could not confirm Abel's assertion (C. A. 17, 2404), that the decrease is due to traces of Cu; it is caused by unexplained accidental conditions. A. ESCHER

Oxidation of combustible gases by cuprous oxide. I. J. ŠVÉDA. *Chem. Listy*, 19, 41-8(1925).—To oxidize combustible gases Š. uses a mixt. of Cu_2O and CeO_2 in a thimble-like furnace made of Marquardt cement, the resistance winding of Pt being totally enclosed in the walls of the thimble. CeO_2 is added to prevent sintering of Cu, resulting from reduction of the Cu_2O , so that the oxidizing mass may be repeatedly regenerated. The thimble furnace is introduced into a eudiometer contg. the gases to be analyzed, and raised to the required temp. It is found that H_2 and CO are quant.

oxidized at 280–90° with N_2 as diluent. No O_2 is necessary. The results with H_2 are satisfactory, but those with CO are always low because of the adsorption of CO_2 by the oxidizing mass. II. J. ŠVĚDA. *Ibid* 73–9.—The thimble furnace described above is enclosed in a combustion pipet so arranged that it may be repeatedly evacuated to remove adsorbed gases. The gases for analysis can be conveniently transferred to and from a eudiometer, in which their vols. are measured. The results show that H_2 and CO are completely oxidized at 280–90° whether pure, in mixt. with each other or with N_2 , so that no O_2 need be used for the combustions.

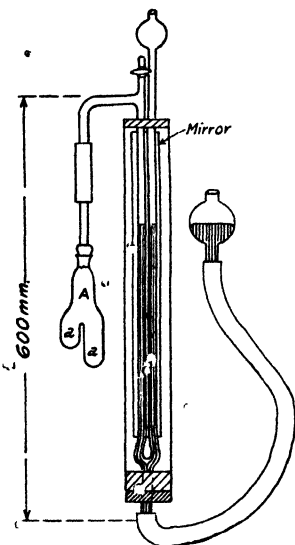
F. C. KRACEK

A new color reaction of nitrites and resorcinol. Effect of vanadium salts. A. NOVELLI. *Anales asoc. quim. Argentina* 13, 13–22(1925).—The reagent is prepd. by dissolving 5 g. pure resorcinol in 150 cc. of distd. H_2O and adding 5 drops of a 26% $FeCl_3$ soln., which gives an intense violet color. On boiling, color slowly fades, leaving a yellow soln. Boiling is continued a few min., then the soln. is cooled. To test for nitrites put a few cc. of the suspected soln. into a test tube, add 1–2 drops of $AcOH$ to free the HNO_2 , and a few drops of the above reagent. In the presence of HNO_2 an intense green color forms. By using 100 cc. of the suspected soln. 1 part of HNO_2 in 10,000,000 can be detd. Mineral acids, alkalies and V salts interfere, the latter in concn. as low as 1/10,000.

E. M. SYMMES

Micro-determination of hydroxyl groups with methylmagnesium iodide according to Chugaev and Zerevitinov. BONIFAZ FLASCHENTRÄGER.

Z. physiol. Chem. 146, 219–26(1925).—Chugaev's method as modified by Zerevitinov (*C. A.* 9, 75) requires 10–300 mg. of sample. By an improvement in the app. the detn. can now be made with 3–10 mg. The Grignard reagent is prepd. from 5 g. Mg, 65 g. dry Am_2O , 45 g. MeI and a crystal of I, and kept in a dark capped bottle where it is stable for several months. The pyridine is kept over BaO . The app. (see diagram) is cleaned out with $CrO_3 + H_2SO_4$, and dried with $EtOH$, Et_2O and warm air. The Hg is purified with HNO_3 and dried at 150°. For the blank detn. 1 cc. of Grignard soln. and 2 cc. of pyridine, resp., are introduced by means of dry pipets into the smaller and the larger recesses *a, a*. The flask *A* is then connected to the app. and placed for 10 min. in a water bath at room temp. By opening the cock and raising the leveling bulb the Hg in the buret is adjusted to the 1 cc. mark. The cock is then closed and the reagent and pyridine are mixed by gentle tapping. After 10 min. in the water bath at the same temp. the increase in vol. is read on the buret. The actual detn. is performed in the same manner except that the sample is first introduced into *a* and allowed to dissolve completely in the pyridine before mixing with the reagent. A no. of substances, *e. g.*, acids, alcs., phenols and glucose gave OH values in close agreement with the theory. Amine. require gentle warming for both hydrogens to react. The entire operation including weighing of the sample can be per-



formed in 25–30 min. The calcn. is the same as that in the macro-detn. A. W. D.

The titration of iodide with iodate. I. M. KOLTHOFF. *Pharm. Weekblad* 62, 878–82(1925).—Lang's method (*C. A.* 19, 2316), based on the formation of ICN is so modified that mere traces of I may be titrated. Instead of using starch as indicator, the disappearance of the violet color of I in CCl_4 is taken as the end point. 0.1 mg. of I may thus be titrated with an accuracy of 1%.

A. W. DOX

Titration of boric acid. M. CIKRITOVA AND K. SANDRA. *Chem. Listy* 19, 179–82(1925).—Boric acid may be titrated by NaOH with phenolphthalein as indicator in concd. solns. of $CaCl_2$ and of $LiCl$ as satisfactorily as in the presence of glycerol and certain sugars. It is supposed that the activity of the acid is increased by the dehydrating action of the added substance.

F. C. KRACEK

The action of sodium carbonate on certain phosphates. A. COLANT. *Bull. soc. chim.* 37, 937–40(1925).—The removal of P_2O_5 in qual. analysis by boiling with Na_2CO_3 (5–15%) for $1\frac{1}{2}$ hr., with subsequent filtration and washing, is not to be recommended for careful work. By this treatment the phosphates of Mn and Ca are scarcely attacked, those of Cr, Sr and Mg half removed and only with Fe and Ba is it effective.

The Na phosphate formed may even react on the metal carbonate or oxide in the presence of Na_2CO_3 to give metallic phosphates. P. B. FLACE

Behavior of cobaltous hydroxide. L. A. TEST AND D. L. SCOLES. *Proc. Indiana Acad. Sci.* **34**, 163-4 (1924).—Pptn. of Co salts with excess of NaOH gives a blue ppt., supposedly consisting of a basic Co compd., which quickly changes to pink $\text{Co}(\text{OH})_2$. The change is retarded by Ni to a degree depending on the quantity of Ni present and this has been suggested as a *qual. test for Ni*. Sol. silicates also retard the color change and unless the NaOH soln. is freshly prepd. or reasonably pure the test cannot be depended on for detection of Ni in presence of Co. A. PAPINEAU-COUTURE

Determination of minute quantities of sugar by the Bertrand method. KARL JOSEPHSON. *Svensk Kem. Tids.* **37**, 184-6 (1925).—Bertrand's method for sugar is favorably compared with the more recent Wiltstätter-Schudel method (*C. A.* **13**, 406). It is considered as accurate for relatively pure samples and more reliable where many unknown substances are present. The table giving the results with the Bertrand method applied to pure maltose shows a max. deviation from the theoretical by 0.5 mg. per 100 mg. By reducing vols. from 20 cc. to 5 cc. and using 0.04 *N* KMnO_4 , the method can be made micro-analytic. A. R. ROSE

Determination of invert sugar in the presence of cane sugar. N. SCHOORL. *Arch. Suikerind.* **33**, 540-3 (1925); *Chem. Weekblad* **22**, 285-6; cf. *C. A.* **19**, 1836.—To overcome the objections to the method previously described, and based on the high cost of KI, it is now proposed to add, after cooling, only 0.3 g. KI. Acidify the solu. carefully and while shaking, with 20 cc. of 25% HCl, and then add at once 10 cc. of a 20% soln. of KCNS. Proceed as usual and find results from the table given previously. The final color change is slightly different from that in the original method, but the use of HCl instead of H_2SO_4 largely overcomes this difficulty in detg. the end point. Detns. of invert sugar in the presence of large quantities of sucrose have shown that in this method the sucrose does not increase the reducing effect of the invert sugar. F. W. Z.

A method for the determination of the rare-gas content of gas mixtures. W. W. LOEBE AND W. LEDIG. *Z. tech. Physik* **6**, 287-90 (1925).—A modification of Warburg's method (*Ann. Physik* **11**, 1 (1890)) is described. The dimensions of the app. are given completely. A table of data for a series of measurements on A-N mixts. shows good agreement with the known compn. J. H. PERRY

The determination of small quantities of impurities in argon and nitrogen. G. HEYNE. *Z. tech. Physik* **6**, 290-2 (1925).—Several methods, phys. and chem., are given for the detn. of the more common impurities found in A and N. A tabulation of the methods used and their sensitivities is included. J. H. PERRY

Determination of sulfur in pyrites. GAETANO CASTELLI. *Rass. min. met. chim.* **63**, 20-1 (1925).—Complete directions are given for the detn. of S in pyrites by the method of Lunge and that of Gyzander in the forms recently approved by the technical committee of the Norwegian Govt. C. C. DAVIS

Determination of vanadium, chromium and titanium in iron ore. OLAF ROBER. *Tidsskrift Kemi Bergvaesen* **5**, 52-5 (1925).—It is recommended to digest 8-10 g. of ore with concd. HCl, reduce the Fe by SO_2 and ppt. by adding Na_2CO_3 and boiling all Ti, Cr, Al and V together with P, As and Mo. Then by fusing with soda and niter, the aq. ext. can be analyzed for Cr, V, etc., and the residue for Ti. C. H. A. ROBAK

Gravimetric determination of copper and its separation from zinc and cadmium. ANT. JILEK AND JAN LUKAS. *Chem. Listy* **19**, 275-7 (1925).—An alc. soln. of the ethyl ester of acetonedioxalic acid ppts. Cu quant. The ppt. does not occlude Zn or Cd. It may be dried at 105° or ignited to CuO . The dried ppt. contains 19.88% Cu, corresponding to the theoretical amt. calcd. from the formula $\text{CuC}_7\text{H}_5\text{O}_7$. The ester dissolves in 95% alc. to the extent of 1.5%; it is difficultly sol. in H_2O , but the alc. soln. is not clouded by the addition of H_2O , so that an excess may be used in pptg. without danger of contaminating the ppt. F. C. KRACEK

Elementary analysis by combustion of organic substances with cuprous oxide in vacuum. J. ŠVÉDA AND O. PROCKE. *Chem. Listy* **19**, 163-8 (1925).—Hackspill and de Heeckeren (*C. A.* **17**, 3006) and Hackspill and D'Huurt (*C. A.* **18**, 2857) published a method of analysis for the elements of org. compds. involving the oxidation by Cu_2O at about 800° ; the CO_2 and N_2 are measured in a gas buret, the H_2O formed is condensed at -80° , allowed to react with CaH_2 , and the resulting H_2 measured. This method makes the detn. of H_2 cumbersome and somewhat uncertain. In the proper procedure, the necessity of decompn. of the H_2O by CaH_2 is avoided. Place the sample for analysis in a quartz tube 150 mm. long, 9 mm. diam. between two layers of Cu_2O . Fill the tube with alternate layers of Cu gauze and Cu_2O and weigh. Insert it into a larger quartz tube in a combustion furnace. Arrange the app. so that it can be evacuated by

a^a Sprengel pump and the gases measured. Provide for the absorption of H_2O by P_2O_5 and of CO_2 by KOH . The temp. used for the combustions is $750-800^\circ$. After combustion weigh the tube contg. the sample; the loss of wt. represents the sample plus the O_2 consumed, the latter being furnished by the Cu_2O . From the 2 weighings and the vols. of CO_2 and N_2 the percentages of C, O, N and H can be calcd. The method is accurate and convenient for the analysis of small quantities of material. F. C. K.

Modification of the method for the determination of volatile organic acids. ANSELM BOHANNES. *Chem. Listy* 19, 121-3 (1925).—To drive off volatile acids glycerol is added to the sample. Distn. is carried on till the mixt. boils at 120° ; H_2O is added and the distn. repeated. The distillates are united and titrated. This method is recommended for the evaluation of the acid content of wines. F. C. KRACEK

Oxygen absorption by anthraquinone- β -sulfonic acid in alkaline solution. T. K. KRUSE. *J. Pharmacol. Proc.* 25, 151 (1925).—Alk. solns. of $Na_2S_2O_4$ alone absorb the least fraction of O very slowly; if anthraquinone- β -sulfonic acid is added to such a soln., the rate of absorption increases and becomes more nearly const. Absorption was accompanied by slight frothing. The most suitable mixt. is: 15-20% $Na_2S_2O_4$, 1-2% anthraquinone- β -sulfonic acid and 10% KOH . Such a soln. absorbed the O in air with in 10-15 displacements. The reagent with KOH indicates complete absorption by a color change; when absorption was complete the color of the soln. wetting the capillary of the absorber remained red. This reagent is not as suitable as the conventional pyrogallol soln. inasmuch as absorption became sluggish within 14 days. C. J. WEST

The production of chloranil from aromatic compounds and its application to organic analysis (MICHELIS, HINCHOT) 10. Preparation and analysis of constant mixtures of air and CO_2 (JOHNSTON, WALKER) 2. Higher oxides of Ag. II. Ag_2O_2 . Analysis and heat of formation (JIRSA, *et al.*) 2.

8—MINERALOGICAL AND GEOLOGICAL CHEMISTRY

EDGAR T. WHERRY

Mineralogical notes 1-10. S. G. GORDON. *Proc. Acad. Natural Sci. Phila.* 77, 1-13 (1925).—New optical data on ancyllite, wavellite, beraunite, cacoxenite, variscite, barrandite, strengite and jarosite are given. The occurrence of rhomboclase and other sulfates formed by decomposing pyritic ore at the Esperanza mine, Cerro de Pasco, Peru is described. The probable identity of chlorotile with mixite is inferred from optical and qual. tests. Other identities are suggested, without chem. evidence.

A new guano-mineral. Preliminary communication. CARL ELSCHNER. *Kolloid-Z.* 27, 31 (1925).—A Mexican clay from an old bat-guano-cavern analyzes: 14.52% $AlPO_4$; 2.40% Al_2O_3 ; a little CaO , MgO and SiO_2 ; and several % of KNO_3 and NH_4NO_3 . No org. matter is present. Its reaction is distinctly acid. F. E. BROWN

The composition of bröggerite and the genetic connection between thorium and uranium. W. RISS. *Sitzb. Akad. Wiss. Wien* 133, IIa, 91-100 (1924); *Science Abstracts* 28A, 378.—A continuation of the investigation of G. Kirsch, who has concluded from analyses of U minerals, in which the ratio of Pb to U and Th to U was detd., that there is a genetic connection between Th and U [see C. A. 17, 2991]. A very large amt. of material has been analyzed, the methods of analysis being described. The results are plotted, Pb/U against Th/U, and at first sight there does not appear to be any regularity; but if it is assumed that some of the ores originally contained a quantity of Pb approximately closely to 0.6%, while others contained little or none of this substance, it becomes possible to draw 2 nearly equidistant curves, about which the observations group themselves fairly satisfactorily, though the agreement with the above theory is not as good as Kirsch obtained with his comparatively few observations. On the whole, however, the new results agree quite well with the assumption that Th is a product of U, and there is evidence in the diagram that there was no Th originally in the crystals analyzed. When crystals from a single pegmatite lode are considered it is found that the relations between Pb/U and Th/U are often very different indicating that the ages of the crystals vary greatly, and it is suggested that some of them were formed in the magma long before the formation of the lodes, while others were formed much later; apparently the latter are generally more brittle than the former, and it may be possible to use them in detg. the age of the lode. H. G.

The meteoric iron of Uegite, Italian Somaliland. F. MILLOSEVICH. *Mem. accad. nazion. Lincei* [5] 14, 501-8 (1923); *Chem. Zentr.* 1924, II, 2454.—Etching a polished

section of a meteorite showed the typical kamacite-taenite structure with Neumann's lines, besides twisted kamacite with inclusions of troilite and some schreibersite. On the surface the kamacite was partially metamorphosed. The meteorite weighed 250 kg. and contained: Fe 92.39, Ni 7.11, Co 0.55, S 0.21 and P 0.11%. C. C. DAVIS.

The determination of platinum in treated and untreated rocks of Germany. R. GANS, C. KRUG AND E. HEUSELER. *Mitt. Lab. Preuss. Geol. Landesanst.* [3], 1922, 1-19; *Neues Jahrb. Mineral. Geol.* 1924, II, 201; *Chem. Zentr.* 1925, I, 829-30.—The rocks suspected of contg. Pt were studied, with all precautions. It was definitely established that in no sample was the high Pt content, such as has been reported, actually present. At the most 0.4-0.6 g. per ton was found, and moreover the concentrates showed no enrichment in Pt. To test out the methods of analysis, a gray wacke was used, into which Pt of the most different grain sizes was introduced. Far too low results were always obtained, usually 15-25% but even 30-45% too little of the added Pt. The results on Pt-bearing rocks are, therefore, not yet conclusive. E. T. W.

The discovery of lode platinum in the Transvaal. F. M. WESTON. *Chem. Eng. Mining Rev.* 17, 425-8 (1925). E. J. C.

An alleged iron deposit at Roseto, Capo Spulico, Calabria. LEO MADDELENA. *Rass. min. met. chim.* 63, 4-6 (1925).—Though it has not been observed before under similar conditions, Fe was found in Tertiary deposits comprising clay, limestone, phthanite, sand, Miocene clay-shale and Pliocene conglomerate. Samples from different localities included 2 which contained 4 and 6.57% Fe, resp. Even these, which were the most promising, are not of industrial value at present. C. C. DAVIS.

Bibliography of clay deposits [of the world]. H. RIES. *J. Am. Ceram. Soc.* 8, *Bulletin Section* 4, 428-510 (1925).—A complete bibliography, arranged by countries. C. H. KERR.

A fundamental study of Japanese coal. I. CHOZO IWASAKI. *Tech. Repts. Tohoku Imp. Univ.* 4, No. 3, 159-61 (1924); cf. C. A. 14, 3306.—Narrow yellow bands (5-20") found in Poronai coal and Sendai lignite are described and shown in photographs. They are similar to the "cuticle" residues found by Thiessen (*J. Geol.* 28, 195 (1920)). B. J. C. VAN DER HOEVEN.

The Halle brown coal field of the Nietleben-Dennstedter basin. SANTELMANN AND HALLE. *Braunkohle* 24, 533-41, et seq. (1925).—The geology of the field is discussed in detail from the standpoint of making possible its complete utilization. WM. B. PLUMMER.

Intrusive basalt under brown coal deposits. W. SCHUCKMANN. *Braunkohle* 24, 562-3 (1925).—A description of a further example of this type formation (cf. C. A. 18, 3582). WM. B. PLUMMER.

Contact-metamorphic assemblages in the system $\text{CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$. C. E. TILLEY. *Geol. Mag.* 62, 363-7 (1925).—Assemblages characteristic of this 4-component system are discussed. The compn. of such assemblages composed of 4 phases is represented in a solid figure, the tetrahedron, the compns. of the various phases being points. J. F. SCHAIRER.

The chemical composition of the petrographic provinces of Russia. F. LOEWINSON-LESSING. *Bull. Comité Geol. (Petrograd)* 2, XLII (1923); *Rev. universelle mines* [7] 7, 214.—The chem. compn. of the petrographic provinces of Russia and in particular the distribution of the alk. basic rocks are not in accord with the concept of 2 universal provinces, the Atlantic and Pacific provinces connected with different types by dislocations of the earth's crust. The mean acidity of the entire mass of eruptive rocks of Russia is identical with the mean acidity of all the eruptive rocks of the earth's crust. Southeast Russia, the Crimea-Caucasus and the Ural present 3 distinct petrographic provinces. All the great regions of crust. rock except the Ural belong to the quartz-diorite type. The Ural has a basaltic compn. corresponding to that at the bottom of the Atlantic and Pacific oceans. If a distinct chem. difference really exists between the continental and the oceanic types, then the Ural, geosynclinal and an ocean bottom, belongs to the ocean type. C. C. DAVIS.

The occurrence of zinc in the Ballachulish granodiorite. FREDERICK WALKER. *Geol. Mag.* 62, 367-8 (1925).—The presence of Zn in this igneous rock is confirmed and quant. data are given. J. F. SCHAIRER.

Petrographical notes on some chloritoid rocks. C. E. TILLEY. *Geol. Mag.* 62, 309-19 (1925).—Petrographical descriptions are given with an analysis of a chloritoid schist. The chem. and mineralogical changes during metamorphism of chloritoid-bearing rocks are represented by equations. J. F. SCHAIRER.

The petrology of Sark. S. W. WOOLDRIDGE. *Geol. Mag.* 62, 241-52 (1925).—A

petrological description including analyses of a hornblende-schist and a massive quartzose-schist. J. F. SCHAIRER

Is the chalk a chemical deposit? W. A. TARR. *Geol. Mag.* 62, 252-64(1925).—T. believes that chalk consists of chem. pptd. calcite and aragonite, chem. formed oolite, and a small amt. of normal org. remains. Variations in the amt. of CO_2 dissolved in sea water caused the pptn. with bacteria as a possible contributing factor. J. F. SCHAIRER

The origin of the Lower Oligocene sea and of the potash deposits of the Middle Rhine valley. L. VAN WERVEKE. *Kali* 19, 273-5(1925).—A brief bibliographical discussion. WM. B. PLUMMER

Temperature in the formation of the salts of the German Permian limestone strata. ERNST FULDA. *Kali* 19, 213-6(1925).—The temps theoretically required for the formation of these salts are shown to be within the range of surface earth temps. which could have existed without any markedly different climatic conditions (air temps.) than those existing at present. WM. B. PLUMMER

Helium in natural gases from oil wells. J. CLAY. *Verslag. Akad. Wetenschappen Amsterdam* 34, 337-8(1925).—Varying quantities of He up to 0.0033% were found in gas samples from Java and Sumatra. B. J. C. VAN DER HOEVEN

Recent researches on volcanism. GAETANO PONTE. *Rass. min. met. chim.* 63, 6-10(1925).—A review and discussion of the present status of knowledge of the chemistry of volcanic action, with particular reference to the work of Brun, Chamberlain and Gautier. C. C. DAVIS

Louis Gentil (1869-1925). E. A. MARTEL. *La nature* 53, ii, 47-8(1925).—An obituary with portrait. C. C. DAVIS

Crystallography of potassium fluozirconate (KERR-LAWSON) 2. K salts in the southern Urals (v. ZUR MÜHLEN) 18.

9—METALLURGY AND METALLOGRAPHY

D. J. DEMOREST, R. S. WILLIAMS

Gold, silver, copper, lead and zinc in New Mexico and Texas in 1923. C. W. HENDERSON. U. S. Geol. Survey, *Mineral Resources of U. S., 1923*, Part I, 593-600 (preprint No. 27, published July 30, 1925). E. H.

Bauxite and aluminium in 1924. J. M. HILL. U. S. Geol. Survey, *Mineral Resources of U. S. 1924*, Part I, 21-9 (preprint No. 4, published Aug. 4, 1925). E. H.

Principles of metallurgy of ferrous metals for mechanical engineers. VI. Alloy steels. LEON CAMMEN. *Mech. Eng.* 47, 832-6(1926); cf. *C. A.* 49, 2798. E. H.

The occurrence of vanadium in iron ores, its behavior in the metallurgical processes and the possibility of its recovery. RUTGER V. SETH. *Jernkont. Ann.* 105, 561-83 (1924).—Most of the European iron ores contg P or Ti will usually contain 0.10-0.20% of V_2O_5 , often more, particularly the ores too high in Ti to be fit for reduction in blast furnaces. By contg. such ores the V is observed to follow the Fe, not the P and Ti as might be expected. In the blast furnace the V is easily reduced and the major part (85-100%) is always found again in the raw iron, even by very cold working. By large slag quantity the amt. of V following the slag is naturally increased. A basic slag seems to favor the reduction of V, so the conditions are most favorable when Thomas raw iron is produced. In the refining the V is oxidized very rapidly, save in cases where the raw iron contains much Si and Ti, since these elements are oxidized before the V. In Thomas-refining the decarburized iron bath will contain only an extremely small part of the V originally present in the raw iron. These facts suggest the following procedure for recovering the V. The raw iron contg. the major part of the V content of the ore, which in most cases will be well fit for Thomas-refining, is refined in two steps at first for 3 min. in an acid converter with acid lining until the V is almost completely oxidized and at the same time all the Si and Ti and most of the Mn but none or very little of the P. The iron is discharged into the ladle used for the transport of the raw iron. The V slag is retained but is then discharged separately by further tipping the converter. Any slag which follows into the iron ladle should be skimmed off. The iron is then charged into a basic converter and is blown further in the usual way. The two steps should be carried out in two sep. converters in order that the V slag shall not be dild. by Thomas crusts. The lime should be charged hot in the second converter. The raw iron should be hot and low in Si in order that the oxidation of V shall not be too much delayed. If the raw iron contains as much as 0.20% V, the V slag will contain

at least 10% V_2O_5 . For the production of ferrovanadium it may be subjected to chlorination, after which the V may be dissolved out as Na vanadate and pptd. as ferrous vanadate by $FeSO_4$. This salt may be reduced by Al or Si or in other ways. S. indicates the application of this procedure in the Swed. iron metallurgy with a consideration of the economy. C. H. A. ROBAK

Barium polysulfide in sulfidizing oxidized ores for flotation. E. S. LEAVER AND H. M. LAWRENCE. Bureau Mines, Repts. of Investigations No. 2698, 4 pp. (1925).—A Cu ore and a Pb ore from Utah were subjected to sulfidizing by sulfides and polysulfides of the alkalis and alkaline earths, also a mixt. of Na_2S and paraffin. The ores were crushed to 10-mesh, sampled and ground to pass 65-mesh. Results indicate that BaS_2 has possibilities as a sulfidizing reagent. On the Cu ore the extn. and grade of concn. were good, while on the Pb ore a lower extn. results than on extn. by Na_2S - Na_2S_2 mixt. or Na_2S_2 and paraffin extn. Results of the use of the various sulfidizing agents are tabulated and briefly discussed. W. H. BOYNTON

Research to determine the size of the gold particles in the Witwatersrand banket ore and their rate of solution in cyanide. K. L. GRAHAM AND F. WARTENWEILER. Bull. Inst. Mining Met. No. 25, 23-5 (1925); cf. C. A. 18, 3162.—A reply to discussion of this paper. In one section of the Witwatersrand goldfield it is necessary to grind the ore to a finely divided state. Microscopic examn. indicates very little difference in the appearance of the particles before and after tube-milling. W. H. BOYNTON

The primitive copper industry in America. GEO. B. PHILLIPS. J. Inst. Metals 1925, (preprint, 7 pp.). E. J. C.

Milling practice at Midvale. C. A. LEMKE. Trans. Am. Inst. Mining Met. Eng. 1925, (preprint, No. 1484-B, 12 pp.). E. J. C.

Determination of the specific gravity as a method of analysis at concentrating mills. STURE MOERTSELL. Jernkont. Ann. 108, 584-99 (1924).—It is proved theoretically as well as by expt. that the method is well suited for detg. the metal content in enriching products. An accuracy of 0.1-0.05% Fe can be attained by developing the method with special regard to the materials and concn. app. used at the mill in question. The method is likely to be adaptable even with lump ore. C. H. A. ROBAK

Some experiments with the Davis magnetic separator. SVEN SCHWARTZ. Jernkont. Ann. 108, 534-49 (1924).—With particle sizes below 0.15-0.20 mm. the Davis separator is superior to the system of 2- and 3-drum separators as regards the purity of the slime. However, with increasing particle sizes this superiority will disappear. C. H. A. ROBAK

Automatic temperature regulation in steel heating furnaces. GUNNAR WALLQUIST. Jernkont. Ann. 109, 111-44 (1925).—An illustrated review of the modern methods and app. used in England and U. S. A. C. H. A. ROBAK

Air heaters for blast furnaces. A. HALLBAECK. Jernkont. Ann. 109, 55-90 (1925).—A theoretical consideration of the advantages and disadvantages of the various types of air heaters suggested for adoption in the Swedish blast-furnace practice, with regard to the particular conditions prevailing at the different works and the consequent advisability of the difference in such conditions being adequately considered when the type of app. is selected. Illustrated. C. H. A. ROBAK

Wood as a fuel in Martin furnaces. ARVID JOHANSSON. Jernkont. Ann. 108, supplementary issue, 192-263 (1924).—The consumption per ton of steel will be about 2.2-3.0 cu. m., in loose measure, of wood contg. 22-30% of hygroscopic water. The content of S in the steel, as compared with coal-fired furnaces, is reduced by up to 0.008-0.010%, most often 0.005%, sometimes only inconsiderably. The wood-gas flame with its high H_2O content will act strongly oxidizing upon the iron and so the percentage of pig iron in the charge as a rule will have to be increased a little. Wood-firing technic in the modern Swed. steel industry is discussed, with a comprehensive account of methods and app. in operation at various works. C. H. A. ROBAK

Improved type of pipe air heaters for the Swedish charcoal blast furnaces. MAGNUS TIGERSCHÖLD. Jernkont. Ann. 109, 1-38 (1925).—The Swed. charcoal blast furnaces with their comparatively low production capacity usually cannot bear the building expenses of the efficient Cowper air heater but in most cases use a pipe heater of the Tholander or similar type. The chief disadvantages of these app. are: (1) a large loss of air (34-44%); (2) low efficiency, since they do not apply the counter-current principle; (3) incomplete combustion of the heating gases, which are brought in contact with cold pipe surfaces before complete combustion has taken place; and (4) the combustion gases give off most of their heat while flowing in upward direction and so produce an uneven temp. over the cross-section of the app. By some improvements in the design these drawbacks have been eliminated or reduced in the app. designed by the author.

Theoretical explanations and several drawings illustrate the construction and operation of the new app. C. H. A. ROBAX

Fuel in the iron and steel industry. E. C. EVANS. *J. West. Scotland Iron Steel Inst.* 32, 66-82 (1925).—After comparing British vs. other practice, E. shows that the value of coke for blast-furnace work depends upon the chem. properties: freedom from moisture, ash and S; and the phys. properties: hardness, resistance to abrasion, freedom from breeze, size and reactivity. The effect of each of these properties is discussed and methods of improving coke quality are outlined. Blast-furnace fuel economy depends largely upon factors outside the control of the manager. W. H. BOYNTON

The Lancashire process and the possibility of its development, as regards the production costs and the quality of the product. C. W. TIDESTROM. *Sernkont. Ann.* 109, 145-57 (1925).—The only advisable way of development, in order to meet the competition of soft ingot steel, charging the hearths with liquid raw iron from a tip large-capacity mixer heated by blast-furnace gas and charged directly from the blast furnace. It should hold a charge sufficient for serving the whole series of Lancashire hearths. When charged into the hearths the raw iron should not contain more than 0.10-0.20% Si. The iron is partly refined in the mixer, most of the Si and Mn and even some C being oxidized. By this procedure costs of production are considerably reduced and a better product is obtained. C. H. A. ROBAX

The Tintic standard reduction plant. A. B. PARSONS. *Eng. Mining J.-Press* 120, 284-8 (1925).—At Harold, Utah is the only plant in America producing fine Ag bullion, merchantable pig Pb, and a rich Cu ppt. directly from ore by hydrometallurgical methods. Brine leaching follows chloridizing in a Holt-Dern blast roaster. For economical reduction the Au content must be low, S less than 4% and Ca low. The process is described; a flow sheet and details of equipment and manipulation are given. Recoveries in 1924 were Ag 87.6, Cu 59.8, Pb 32.4 and Au 7%. W. H. BOYNTON

Ancient iron from Richborough and Folkestone. J. N. FRIEND AND W. E. THORNECROFT. *J. Iron Steel Inst.* 1925 (preprint, 8 pp.). E. J. C.

"Armco" iron. ALBERT SAUVEUR. *Rev. métal.* 22, 397-9 (1925).—Brief outline of the process of manuf. and properties. A. PAPINEAU-COUTURE

The persistence of austenite at elevated temperatures. R. C. BAIN. *Trans. Am. Soc. Steel Treating* 8, 14-22 (1925).—The stronger at. bonding between unlike atoms, which is necessary for any solid soln., is offered as the cause for the easier retention of austenite in alloy steels. No sep. explanation is required for the 2 classes of alloying elements. The temp. to which the preserved austenite must be heated for release or decompn. is charted for a no. of common steels and is offered as a measure of its persistence. The similarity in effect of temp. elevation and cold work upon austenite is shown, and the unusually rapid hardening of austenite steels by cold work is explained by X-ray evidence of α -Fe production in a form resembling martensite. An explanation is offered for the unexpected presence in some steels of more austenite when quenched in oil than when quenched in water. It is suggested that the more violent quenching stresses actually deform the austenite grains and cause transformation. W. A. MUDGE

The manufacture of iron and steel. F. T. SISCO. *Trans. Am. Soc. Steel Treating* 8, 191-240 (1925).—An article selected primarily for its educational and informational character as distinguished from reports of investigation and research. W. A. M.

Manufacture of high-silicon irons and their application by the water-works engineer. W. H. SCOTT. *J. Am. Water Works Assoc.* 14, 29-31 (1925).—Resistance to corrosion increases with the Si content, being most marked between 13% and 14.5% Si. Above 15% the increased resistance does not justify the higher cost of manuf. For severe corrosion, a max. C content of 0.80 should be insisted upon. Uniformity of composition is a primary requisite. The material is especially valuable in handling alum and Cl. D. K. FRENCH

Iron-carbon diagram and the most important constituents of plain carbon steels. KARL DAEVÉ. *Stahl u. Eisen* 45, 427-34 (1925).—The paper is an accurate, rather elementary though authoritative review of the current knowledge concerning the Fe-C diagram. Its purpose seems to be to define the various microconstituents and especially to place on record the accepted lettering of the diagram. A. HUNGELMAN

Effect of other elements upon the migration of carbon in steel. E. G. MAHIN, R. C. SPENCER AND C. R. HAYNER. *Proc. Indiana Acad. Sci.* 34, 177-80 (1924).—Increasing Si or Mn as silicides or Mn alloys in carburizing mixt. increases tendency of the Fe to absorb C. JACK J. HINMAN, JR.

Volatilization of manganese in the manufacture of iron and steel. M. M. KARNAUKHOV. *Messenger technico-économique russe* Nos. 8-9, 648-51 (Aug.-Sept., 1924); *Rev. métal.* 22 (Extraits), 358 (1925).—K. shows that in all the processes of Fe and steel

manuf. the vapor tension of Mn is rather high and the quantity of Mn volatilized is sufficiently large to be of practical importance. A. PAPINEAU-COUTURE

Origin of the design on damascene steels. A. P. VINOGRADOV. *Messageur tecnico-économique russe* Nos. 8-9, 661-3 (Aug.-Sept., 1924); *Rev. métal* 22 (Extraits), 359 (1925).—In agreement with Belaiev, V. considers damascene steel as an ordinary steel which has been subjected to a special mech. treatment. With a heterogeneous steel which had a striped texture, he succeeded in reproducing all the different designs of damascene steels. Quenching, tempering and annealing do not destroy the design, confirming Belaiev's opinion that the initial microstructure of steel cannot be destroyed by the usual methods of thermal treatment. A. PAPINEAU-COUTURE

Thermal treatment of steel wires during drawing. S. STEINBERG. *Messageur ind. métaux russe* Nos. 1-3, 149-55 (Jan.-March, 1924); *Rev. métal* 22 (Extraits), 368 (1925).—Discussion of the importance of the proper control of temp., both of the wire and of the Pb bath, showing the effects of variations in temp. on the mech. properties of the finished product. A. PAPINEAU-COUTURE

Evolution of the utilization of power in gas and steam plants in the iron and steel industry. MAURICE DERCLAYE. *Rev. métal* 22, 313-32, 435-49 (1925). A. P.-C.

Manufacture of ferro-manganese by means of charcoal at the Nadiédinskii blast furnace (district of Bogoslovskii), Ural. A. FANBOULOV. *Messageur ind. métaux russe* Nos. 4-6, 137-42 (April-June, 1924); *Rev. métal* 22 (Extraits), 321-2 (1925).—Data are given on the charges and compn. of the alloy and slag during the run of April 1-May 18, 1921. A. PAPINEAU-COUTURE

Carrying out the open-hearth process with scrap iron and scrap steel, without addition of pig iron, but with addition of coke and of manganese ore to the charge. G. Y. CHAKH-PARONIANTS. *Messageur ind. métaux russe* Nos. 4-6, 67-72 (April-June, 1924); *Rev. métal* 22 (Extraits), 322-3 (1925).—The charge consisted of pig iron 110, shell iron 230, iron scrap 160, iron in lumps 1210, roofing sheets 560, rolling mill scrap 130, peat coke 60, Mn ore 73, limestone 233 pounds. It was unnecessary to deoxidize with ferro-Mn. The economy is estd. at 12.25 roubles per 100 pounds of good steel. A. PAPINEAU-COUTURE

Influence of temperatures on the strength of cast steel. FR. KOERBER. *Stahl u. Eisen* 44, 1765-71 (1924).—Opinion is current that at blue heat cast steel is less ductile or tough and so less fitted for high-pressure boilers, turbines, gas engines and pressure tanks in chemical industry for high temps. Tests show max tensile strength at 200-300°. The notched-bar impact test seems not to have been used for this purpose. K. applies it to 3 steels, Bessemer, basic open-hearth and basic electric. His important conclusions from many tests, based on notched-bar impact values, is that there is no lowering of strength up to blue heat, but rather a gain. The lower elongation noted at the higher temps. cannot be characterized as increased brittleness since the impact values are greater at the higher temps. A. HUNGELMAN

The magnetic properties of cast iron. HUGH O'NEILL. *Electrician* 95, 152, 155 (1925).—Cast Fe possessing magnetism may be classed as magnetically hard or magnetically soft. It is used for magnets because of its constancy (resisting shock and tumbling losses more than steel does), its comparative freedom from stress effects and its adaptability in shaping. The effects of the condition of the C in the metal are pointed out and the importance of compn. and heat treatment are discussed. Dissolved gases have a considerable influence upon the magnetic properties. Several tables, typical figures for cast Fe magnets and a short bibliography are included. W. H. BOYNTON

Krupp steel V2A as a substitute for platinum in the chemical laboratory. W. A. ROTH. *Krupp Monatsh.* 6, 157-61 (1925).—Bomb calorimeters made of V2A steel proved quite satisfactory, showing slight soln. of Fe on first combustion, about 0.40 mg., but this quickly dropped to practically nothing on the 8th combustion. Curves are shown. This bomb is better than bombs made of other Pt substitutes. V2A can also be used for other lab. app. such as potentiometers, as a thermoelement with constantan, as a material for crucibles and dishes, etc. H. STÖRZ

Stainless or rustless iron correctly described as stable-surface iron. P. A. E. ARMSTRONG. *Trans. Am. Soc. Steel Treating* 8, 163-87 (1925).—Rustless Fe is not entirely resistant to surface corrosion. The film-forming characteristic that protects these alloys from serious corrosion is also the cause of discoloration. They are only stainless when conditions are favorable; such conditions, are, however, quite destructive to ordinary Fe and often to non-ferrous metals. Rustless iron must be produced free from included dirt, otherwise pitting will readily take place. A pickled surface on rustless Fe is quite as good as a polished surface and less costly. Bronzes do not always cause

rustless Fe to corrode in the presence of an electrolyte, and care should be exercised to obtain a suitable bronze metal for bearing applications. Auto-electrolysis plays an important part. Cooking utensils are not free from danger. Rustless Fe seems to be without harmful effect. Phys. properties of rustless Fe will bear careful scrutiny; they can be improved by the use of alloys. Ni does not appear to raise the proportional limit. W. A. MUDGE

A remarkable steel crystal. J. S. G. PRIMROSE. *Trans. Am. Soc. Steel Treating* 8, 37-5 (1925).—A crystal weighing 3 lb. and having a length of 19" was taken from the pipe cavity of a 50-ton mild steel ingot. Diagrams and photomicrographs illustrate the author's theory of the formation of fir-tree crystals of this nature. W. A. MUDGE

Magnetization and crystal orientation. W. E. RUDER. *Trans. Am. Soc. Steel Treating* 8, 23-9 (1925).—Single crystals of Si steel of varying orientations were tested for magnetic permeability. Wide variations were found between the magnetization of the strips (10 x 0.5 x 0.025 in.) depending upon their crystal orientation with respect to the direction of impressed magnetic field. The permeability of crystals having their cube edges perpendicular and parallel to the direction of the applied flux was from 10 to 25 times that of crystals having their cube edges at an angle. The lowest magnetic permeability was obtained when all edges were at 45° with the direction of flux. Over 100 samples were examined. Curves and photomicrographs are given showing the change and magnetization as the orientation changes. W. A. MUDGE

The story of steel treating. PRENTICE WINCHELL. *Iron Age* 116, 593-604 (1925).—An illustrated historical review. E. J. C.

The dilatation of cast irons during repeated heating and cooling. J. H. ANDREW AND ROBT. HIGGINS. *J. Iron Steel Inst.* 1925 (preprint, 24 pp.). E. J. C.

Comparative cold-rolling tests of open-hearth steel strip (deep-drawing stock) and electrolytic-iron strip. J. R. FREEMAN, JR. AND R. D. FRANCE. *Bur. Standards, Tech. Paper No. 288*, 297-313 (1925).—Representative lots of the two types of material were cold-rolled under identical conditions—both mild and very severe rolling practice. Hardness, Erichsen, tensile and bend tests made on samples in each stage in rolling show that electrolytic iron does not harden so rapidly and does not increase in tensile strength so rapidly with cold-rolling as the open-hearth steel used for deep-drawing operations. In general, the tests indicate a slight superiority for the electrolytic product. W. H. BOYNTON

Effect of hot-rolling conditions on the physical properties of a carbon steel. J. R. FREEMAN, JR. AND A. T. DERRY. *U. S. Bur. Standards, Tech. Papers* 18, 547-66 (1924).—Tests on the unidirectional rolling of steel billets indicated that the total reduction and the finishing temp. are the 2 most important factors in rolling. A higher degree of reduction increases the yield point, ductility and impact resistance of the steel but decreases the ultimate strength. Ductility and impact resistance improve as the finishing temp. of rolling is lowered from 1000° to 700°, a temp. approximating to the A_1 transformation. The mech. properties were slightly inferior in the direction transverse to that of rolling. Other properties, e. g., d., hardness, macrostructure, seemed to be little affected by the difference of treatment in rolling. B. C. A.

Foundations for heat-treating commercial alloy steels. F. W. DUESING. *Mit. Kaiser-Wilhelm Inst. Eisenf.* 6, 71-135 (1925).—For a number of construction steels, contg., resp., Mn, Mn-Si, Ni, Cr-Ni and Cr as alloying elements, D. investigated the transition phenomena in the critical range. Both the thermal analysis method and the detn. of the hardness as a function of the quenching temp. were used. For a proper heat treatment the knowledge of the A_{c3} point is indispensable. This point cannot be properly located on the heating curve. On the other hand the quench temp.-hardness curve gives reliable results. Mechanical tests made on a Cr-Ni steel confirmed the results of the quench-hardness method. The effect of annealing (heating of test bars for 90 min. at temps. ranging from 600-1000°, followed by cooling for 48 hrs. in ashes) on the mechanical properties led to the conclusion that a little below A_{c1} the steels were in their softest condition. Photomicrographs of steels thus annealed showed the cementite to be spheroidized. A considerable amt. of work was done on the effect of different methods of quenching and tempering on the mechanical properties and microstructure of the above-mentioned alloy steels. The results are represented in numerous tables, cuts and photomicrographs (at 500 diams.). Dynamic tensile tests by the method of Koerber and Simonson showed that invariably more energy is required to break the specimens than in the ordinary static tensile test machines. The article is concluded by a comparative study of the relation between (1) Brinell hardness, (2) Shore hardness, (3) Wuest-Bardenheuer hardness and (4) tensile strength. H. S. VAN KLOOSTER

Oxyacetylene cut does not injure ductility of steel. *Eng. News-Rec.* 94, 939

(1925).—Tests at labs. of Union Carbide and Carbon Co., N. Y. City, showed that flame cutting does not injure the metal, both strength and ductility of flame-cut surfaces being equal to those of milled or hacksawed surfaces. A slight hardening effect of the flame was indicated in the strength figures but milling off of $\frac{1}{8}$ in. from flame-cut surface removed the hardened metal. The tests indicated that shearing produces marked reduction in ductility.

R. E. THOMPSON

Characteristics of permanent magnet steel with special reference to radio requirements. R. P. DEVRIGS. *Trans. Am. Soc. Steel Treating* 8, 139-49 (1925).—A graphic presentation of data obtained on several types of magnetic steels especially for use on radio equipment. It is not desirable in the standardized mfg. processes to vary hardening operations. Good magnet steel demands a high av. value for both residual induction and coercive force.

W. A. MUDGE

Rational utilization of electricity in the electrothermal iron, steel and ferro-alloy industry. MATHIEU AND SUTTER. *Rev. métal.* 22, 477-89 (1925).—Discussion of the development and present status of the electrometallurgy of Fe. steel and its alloys, and more particularly of the efficient utilization of elec. power.

A. P.-C.

Effects of quenching and tempering on the thermoelectric e. m. f. of some steels. P. NICOLAU. *Rev. métal.* 22, 539-44 (1925).—Results of tests carried out by Galibourg's method (C. A. 16, 2295) on extra-mild, semi-mild, semi-hard and hard steels which had been subjected to various thermal treatments, are tabulated and plotted and compared with the Brinnell hardness. Precautions to be taken in carrying out the method in order to obtain consistent and accurate results are outlined. The curves obtained by plotting thermoelec. e. m. f. against tempering temp. consists of 2 straight lines which meet at an angle the portion which corresponds to tempering above 250-300° being horizontal, and that below 250-300° being more or less inclined. The point corresponding to oil quenching without tempering lies on the prolongation of the horizontal-line portion of the graph, showing that the thermoelec. e. m. f. is changed by quenching only when austenite persists at ordinary temp. The detn. of thermoelec. e. m. f. can thus be used as a convenient and fairly sensitive method for the detection and approx. quant. detn. of this constituent, which usually escapes detection when small proportions of it are present with large quantities of martensite or of troostite. The method can be used for controlling the effects of quenching, and is simpler and more reliable than the Brinell or tensile tests.

A. PAPINEAU-COUTURE

Rust-resisting steel V2A, and apparatus constructed thereof. B. STRAUSS. *Krupp Monatsch.* 6, 149-57 (1925).—This steel contains 20% Cr, 7% Ni and 0.2% C, photomicrographic examn. showing a mixed crystal-austenite structure in which C, Cr and Ni are completely dissolved. V2A not only possesses good mech. strength, 70-80 kg. per sq. mm., 50% elongation, but is very inert to chem. action. The wt. in g. p. hr. per sq. mm. of metal dissolved in various reagents at temps. from 20° to 150° is as follows: HNO₃ concd. at 20° 0.00 g., boiling 0.02 g.; HNO₃ + 5% H₂SO₄ boils 0.59 g.; H₂SO₄ at 20°, 10% 0.07 g., 30% 0.16 g., 66% 0.001 g., 98% 0.012 g., 20% boiling 36.0 g.; 58% H₂SO₄ + 40% HNO₃ + 2% H₂O at 20° 0.00 g., at 60° 0.05 g., at 100° 0.70 g., 110° 7.6 g.; 80% H₃PO₄ at 115° 134.3 g.; 50% KOH soln. boiling 0.40 g.; KOH at 360° 3.5 g., at 600° 37.9 g.; CuCl₂ soln. boiling 1-1 464.0 g.; FeCl₃ soln. 1-1 101.0 g. at 50°; other salts and acids, only slight action. V2A has a sp. gr. 7.86, sp. heat 0.18, thermal cond. 0.04, coeff. of expansion, 0-100° 16 × 10⁻⁶, 0-600° 18 × 10⁻⁶, 0-1000° 20 × 10⁻⁶, m. p. 1400°. This steel permits of autogenous welding and can be cold-drawn, or stamped, permitting its use in the manuf. of many types of equipment, photographs of which are shown. Special heat treatment is needed, the temp. being raised to 1170° and the alloy then quickly cooled. For acids which attack V2A, 2 special alloys are made, V4A and V6A, contg. Mo and Cu. V2A also finds application in the canning industry.

H. STOERTZ

The causes of inverse liquation of ingots. G. MASING. *Z. Metallkunde* 17, 251-7 (1925).—On rapid cooling of a liquid alloy from which a solid soln. seps., the crystals on the outside of the ingot are sometimes richer in the second constituent than those in the center, which is contrary to the expectation. The pronounced inverse liquation in Zn-Cu alloys, rich in Zn, observed by Iokibe (C. A. 19, 1686), led M. to repeat these expts. The alloys investigated contained 10-28% Cu. They were cast in metal dies of 35 mm. diam. In nearly all cases inverse liquation was observed, the edge contg. 0.4-3.6% more Cu than the center. Like Iokibe, M. concludes that the phenomenon is caused by the apparent vol. increase due to solidification with formation of pores which subsequently absorb the liquid melt surrounding the crystals first formed. A calcn. by the author indicated that the contraction of the solidifying alloy (5-7%) cannot account to any noticeable extent for the inverse liquation taking place. In the case

of Sn-Cu alloys (8-15% Sn), M. was able to show that undercooling and incomplete diffusion are sometimes also factors in producing inverse liquation. H. S. v. K.

The structure of alloys. A. WESTGREN AND G. PHRAGMEN. *Kolloid-Z., Spec. No.*, Apr. 1, 1925, p. 86-91.—From a consideration of the results obtained by X-ray methods (cf. C. A. 18, 2093) these 2 structural types are defined as limiting cases: (1) in an ideal solid chem. compd. the structurally equiv. atoms are also chem. identical; (2) in an ideal solid soln. all the atoms are structurally equiv. Most metallic phases are intermediate products between the 2 ideal types. Many phases of alloys are solid solns. in intermetallic compds. In order to establish with certainty the formulas of the latter one must know in what way the atoms of the elementary parallelepipeds are distributed in the groups of structurally equiv. individuals. By X-ray methods the γ -phases of the alloys CuZn, AgZn and AuZn contg. 60 to 69% Zn atoms are known to be cubic and have 52 atoms in the elementary cube. The distribution of 52 atoms into only 2 groups of structurally equiv. individuals excludes entirely the formulas often given, Cu_3Zn_8 , Ag_3Zn_8 , and Au_3Zn_8 . The simplest arrangement would be Cu_8Zn_4 and Cu_8Zn_8 , but since many other combinations can give the sum 52 it is not possible to assign a definite formula. Certain structural types have been found to recur in different alloys. The systems CuZn, AgZn, AgCd, AgAl, CuSn and AgSn have all been found by powder photographs to correspond to the interference diagram of a lattice of spheres closely packed in hexagons. This correspondence in the structure of metallic phases shows a dependence between the different alloy systems which must be of importance in the defn. of the laws of intermetallic reactions. H. M. McLAUGHLIN

Properties and structure of some alloys of aluminium-chromium. F. T. SISCO AND M. R. WHITMORE. *Ind. Eng. Chem.* 17, 956-8 (1925); cf. C. A. 19, 1846.—Cr alloys with Al easily but it increases the shrinkage of Al to a marked extent. The alloy is apparently AlCr_3 , which is insol. in the metal when cold. Heat-treatment at 600° will not cause AlCr_3 to go into soln. Al-Cr alloys have higher tensile strength than pure Al. Their properties do not compare favorably with those of Al-Cu alloys. Al-Cr alloys have no com. value because of their brittleness and shrinkage. W. H. B.

Colloidal separations in alloys. J. H. ANDREW AND ROBERT HAY. *J. Inst. Metals* (advance proof), Sept., 1925, 3 pp; *Engineering* 120, 311.—After soaking β -brass at 450° for some time under the influence of an a. c., hard grayish globules of γ -brass were microscopically visible. This supports Carpenter's view that at 475° , β -brass undergoes a eutectoid transformation into its constituent phases α and γ . Two specimens of duralumin of nearly equal vol., one quenched from 500° in cold water, the other annealed, were counterbalanced while immersed in paraffin oil. Wt. fluctuations showed a rapid and appreciable expansion following quenching, followed by slow decrease in sp. vol., suggesting initial colloidal deposition, followed by crystn. into smaller vol. The elec. resistance of similarly treated strips showed analogous changes. Inconclusive expts. indicate that a. c. increases aging rate. Dilation curves of quenched samples showed a gradual change of form at about 250° . The transformation is gradual over a wide temp. range, indicating gradual deposition of finely dispersed substance, rather than deposition of true cryst. substance. The facts "point to some colloidal agent being responsible for the aging in Al alloys." Work is being continued. JEROME ALEXANDER

Magnesium and its alloys. SAMUEL DANIELS. *Mech. Eng.* 47, 796-9 (1925).—A review of properties, manuf. and uses. E. H.

The compound AuCu in gold alloys. L. STERNER-RAINER. *Z. Metallkunde* 17, 162-5 (1925).—The compd. AuCu separates out in long, light yellow needles from slowly cooled alloys of Cu and Au, contg. 56.5% to 93.0% Au and from Cu-Ag-Au alloys, the compn. of which falls within the region bounded by lines joining the Ag corner of the ternary diagram to the pts. on the Cu-Au side corresponding with alloys of the above compn. Even after prolonged annealing at 750° the compd. fails to redissolve in the mixed-crystal ground masses but rapid cooling of the alloy through the range 503° to 20° suppresses the sepn. of the compd., reduces the hardness and tensile strength of the alloy and increases the ductility. J. H. PERRY

Aludur. K. HALLMANN. *Z. Metallkunde* 16, 433-5 (1924).—The various grades of this com. alloy, of Al base but carefully undisclosed compn., have a Brinell no. of 80-110, tensile strength 27-45 kg./sq. mm. Its mech. and elec. properties and its machinability are claimed to give it a wide range of usefulness. Wm. B. PUMMER

Investigations of the specific resistance and the temperature coefficients of alloys of the manganin series. S. ZHEMCHUZHNI AND V. NEMILOV. *Ann. inst. anal. phys.-chim.* (Russ.) 2, 450-63; *Chem. Zentr.* 1925, I, 1236-7.—If the compn. of manganins is represented by the % formula: Ni 4, Cu (100-x), Mn ϵ , then the sp. resistance ξ

of the alloy increases as α is increased from 9.3 to 14.4. Annealing for 6 hrs. at 180° decreases ξ . The temp. coeff. α of ξ becomes 0 between 5° and 25° and it is very small or even negative between 25° and 100°. A new annealing for 48 hrs. at 600° reduces ξ again, but increases α and changes its sign. Instead of alloying Mn and Ni with Cu, "ferromanganins" can be prepd. from Cu and ferromanganese. Their ξ values are only slightly higher than those of the corresponding manganins, the values of α are of about the same magnitudes and the thermoelec. tension towards Cu is lower. Thus an alloy of the % compon.: Cu 80.8, Mn 16.2, Fe 2.5, Si 0.35, showed $\xi \times 10^6$ at 5°, 60.28; at 25°, 60.28; at 100°, 59.769. After annealing at 180° $\xi \times 10^6$ was at 5°, 59.203; at 25°, 59.203; at 100°, 59.130. After annealing at 600° it was at 5°, 37.52; at 25°, 37.904; at 100°, 39.054. C. C. DAVIS

• The aging at elevated temperatures of self-improving aluminium alloys. K. J. MEISSNER. *Z. Metallkunde* 17, 77-84(1925).—M. reviews the work of previous investigators on duralumin and other Al-Cu alloys. He studied the effect of the temp. at which duralumin (free from Mg) is aged, on the Brinell hardness. The samples were annealed at 510° and quenched. The aging took 16 hrs. in each case. The hardness increased from 85 (at 20°) to 115 (at 150°), then dropped to 93 (at 200°). Aging for different lengths of time (up to 240 hrs.) at 20°, 75°, 121° and 146° showed that at 20° the hardness remains practically const. after 20 hrs. of aging. At 75° and 121° there is a continuous increase in hardness, first rapid (up to 16 hrs.) then more gradual. At 146° a max. hardness of 128 is reached after 6 days' aging. Longer aging reduces the hardness (122 for 12 days of aging). From these and other data M. plots a curve giving the relation between temp. of aging (as ordinate) and length of aging in days. There is first a sudden drop from 200° to 155° followed by a slow falling off. The bend at about 150-160° is called the crit. temp. of aging. In continuation of the work of Gayler (cf. C. A. 18, 45), M. performed some expts. on Al alloys contg. both Cu and Mg. The specimens were annealed at 510°, quenched in water and then aged for 5 days at room temp. After that they were aged for 16 hrs. at temps. of 50°, 100°, 150° and 200° and finally tested for elongation, tensile strength and flexibility (resistance to bending). The elongation reaches a max. at 100°, then decreases rather suddenly around 125° and from 162.5° on to 200° falls slowly. The tensile strength decreases to a min. at 100° corresponding to a coagulation of Mg_2Si particles to larger complexes. There is an increase of tensile strength from 100° to 162.5° which M. with Gayler ascribes to the sepn. of finely dispersed $CuAl_2$ particles. After the max. is reached the tensile strength drops again because of the coagulation of the $CuAl_2$ particles. The flexibility curve shows a min. at 75°, then a max. at 125°, a min. at 162.5°, then rises again. Conclusion: Aging at higher temps. of Al alloys, previously aged at room temp., cannot be recommended. Aging at high temp is only useful when applied directly after quenching in water. For alloys free from Mg it is immaterial whether they are aged at higher temps. directly after quenching or after being aged at room temp. for a considerable time. H. S. VAN KLOOSTER

• Computing ferroalloy additions. J. B. GEORGE. *Foundry* 53, 694-6(1925).—G. shows an alloy mixt. calculator for ferromanganese in the form of a chart, whereby the amts. of alloy in lbs., pig iron in lbs. to be added to a 1000 lbs. (454 kg.) and the % of available C in pig iron and the available Mn in the alloy are shown at a glance. The available alloying element of the alloy is the total element minus the desired element content of the steel being produced. W. H. BOYNTON

Passivation and scale resistance in relation to the corrosion of aluminium alloys. L. H. CALENDAR. *Engineering* 120, 340-2(1925); *J. Inst. Metals* (advance proof) Sept., 1925, 25 pp.—To the electrochem. conception of corrosion must be added a knowledge of the chem. and phys. properties of $Al(OH)_3$ scales. Al, Al-Cu and Al-Cu-Zn alloys in water were markedly protected by adding $NaNO_3$ in concns. above 0.005%. In lower concns. the $NaNO_3$ was rapidly reduced and corrosion proceeded. The quantity of $NaNO_3$ required increased with increasing chloride concn. The rate of formation of the scales in solns. of various salts was studied by measuring the resistance and e. m. f. of cells made of pairs of the test metals. The resistance increased rapidly in the presence of salts which cause passivity such as $K_2Cr_2O_7$. Eight parts $K_2Cr_2O_7$ per 100,000 of tap water prevents the corrosion of Al. The protection of Al by oxidizing salts is due to the formation of an impervious oxide scale. Low concns. of salt may give incomplete protection at points and cause pitting. Dichromate is particularly effective because it is adsorbed by the film of $Al(OH)_3$ forming a very insol. scale. This scale will protect Al for a long time in pure water. When it breaks down it shows green chromic hydroxide from the adsorbed chromate. E. L. CHAPPELL

• Notes on the properties of tin. P. G. J. GUETERBOCK AND G. N. NICKLIN. *Metal*

Ind. (London) **27**, 118-20, 143-4 (1925).—The properties of and the effects of impurities on Sn are discussed. Workshop tests for purity include: (1) the bend test, in which 5 classes of bend are listed and illus.; (2) the appearance test, which is divided into 6 classes. Impurities with the exceptions of Sb and S lower the m. p. of the tin. The effects of impurities on mech. properties, such as hardness, compression, tensile tests, the sp. gr. and their effect on dressing are indicated in tabulated results.

W. H. BOYNTON

The effect of impurities on the properties of tin. P. G. J. GUETERBOCK AND G. N. NICKLIN. *J. Soc. Chem. Ind.* **44**, 370-4T (1925).—Complete analyses are given for 6 com. brands of pure Sn and 3 of ordinary Sn, the total % impurities of the former ranging from 0.0082 to 0.34% and of the latter from 0.82 to 0.89%. With the purest sample (0.0082% impurities) the effect of 2 different added amts. each of Pb, Sb, Cu, Bi, As, S, Fe and Zn on the f. p., Brinell hardness, compression yield point, tensile strength, bending test, sp. gr., elec. cond. and amt. of dressing were detd. The more salient points observed are noted in the following: *Pb*.—Addn. of 0.0455% caused softening but 0.2505% hardened the alloy and slightly reduced ductility. *Sb*.—The f. p. was raised slightly and dressing increased considerably. *Cu*.—0.0416% softened the alloy but 0.0496% hardened it; the latter % slightly decreases the ductility and considerably increases dressing. *Bi*.—0.056% decreased the sp. gr. and increased dressing, the mech. tests being inconsistent. *As*.—0.055% caused marked hardening and loss of ductility, also lowering the sp. gr. appreciably. *S*.—0.036% caused a slight rise in f. p. and considerable decrease in elec. cond., dressing being increased. Higher (0.7%) amts. change the properties completely, e. g., produce actual brittleness. *Fe*.—0.058% increased the sp. gr. and the dressing appreciably. *Zn*.—0.04% did not have any marked effect, but 0.24% (which might easily be introduced in melting up scrap tin without proper sorting) doubled the hardness no. and correspondingly decreased the ductility. Detailed tables and 4 photographs are given.

WM. R. PLUMMER

Revision of the equilibrium diagram of the copper-zinc system. DAIZI IITSUKA. *Mem. College Kyoto Imp. Univ.* **8**, 179-212 (1925).—A careful redtn. of the Cu-Zn diagram reveals considerable discrepancies between the results obtained by I. and previous investigators. The liquidus line coincides practically with the one obtained by Roberts Augten and others but the position of the solidus line and of the transition lines (peritectics) is not the same. The following differences are to be noticed. The area of the α -crystals extends only to 66% Cu and above 700° to 64% Cu. The peritectic at 894° extends from 61 to 69% Cu. The next one at 833° runs from 39 to 43% Cu. The third for 20 to 30% Cu lies at 692°. The fourth at 592° has the limits 13 and 23% Cu. The peritectic at 423° ranging from 2 to 13% Cu coincides with Shepherd's line. The eutectic transformation $\delta \rightleftharpoons \epsilon + \gamma$ takes place at 560° (more than 100° above Shepherd's line) between 22 and 30% Cu. The $(\delta + \gamma)$ -field exists at 26-30% Cu between 500° and 560°. Special attention was paid to the transformations taking place around 470° between 42 and 66% Cu. Samples of 25 g. with a bore reaching to the interior were packed in carbon black, heated to 550° in a vertical elec. tube furnace and slowly cooled. The β -solid soln. changed at temps. ranging from 475° to 460° into a β_1 -modification and this, about 10° lower into a β_2 -phase, the max. temps. (475° and 465°) being observed at 53% Cu. These results agree in part with those of Desch. Between 51 and 56% Cu the final product was always the β_2 -phase and not a bistructural $(\alpha + \gamma)$ -product as assumed by Carpenter and Edwards. A number of expts. were carried out by heating brasses of diff. compn. for 5, 25 and 50 hrs. at 470-500° in sealed tubes cntg. air and *in vacuo*. In both cases losses of Zn of 0.5% *in maximo* were noted, with one remarkable exception. A brass with 65% Cu at the boundary between α and $(\alpha + \beta_2)$ does not lose Zn, however long it be heated around 500°.

H. S. v. K.

The oxidic-sodium chloride test for aluminium. F. MYLIUS. *Z. Metallkunde* **17**, 148-54 (1925).—The resistance of Al to seawater was estd. from the corrosion of samples in a dil. NaCl-H₂O₂ soln. The action of boiling Na₂CO₃ soln. in forming protective films was studied. These films were more protective than the original surface produced by drawing. Iron as an impurity gave non-protective black films. Heating to 350° in air caused passivity.

E. L. CHAPPELL

The absorption of iron by aluminium. A. W. SCHMIDT. *Z. Metallkunde* **17**, 96-7 (1925).—The av. analysis of Al bars as tested by S. gave 0.43% Fe and 0.47% Si, the rest being Al. The bars were poured from graphite crucibles into Fe molds lined with graphite. On taking shavings from the surface S. found that the Fe content varied from 1.41 to 1.70% and the Si from 0.82 to 1.17%. A layer of about 0.4-0.6 mm. has to be removed to obtain normal analysis. Shavings taken from the bottom, sides and

top of a rectangular block of Al showed the least Fe content at the bottom (0.5% Fe, 0.61% Si) and a max. Fe and Si content on the side where the metal was poured against the mold (1.37 and 0.91%, resp.). The different surface colorations observed in Al castings might be caused by diff. contents of Fe and Si. A thin yellow layer contained 8.1% Fe and 0.63% Si, a steel-blue piece 1.9% Fe and 0.58% Si, a green sample 2.1% Fe and 0.63% Si.

H. S. VAN KLOOSTER

Testing for porosity in aluminium castings. R. J. ANDERSON. *Metal Ind.* (London) 27, 145-6 (1925).—The principal tests for detecting porosity in Al-alloy castings are: (1) the open test with a soln. of methylene in gasoline; (2) the metallographic test; (3) the water-pressure test; (4) the air-pressure test and (5) the steam-pressure test. Each test is outlined and a special air-pressure porosity test app. for measuring the porosity of a cast test cup is described and illus.

W. H. BOYNTON

Die casting and its problems. L. FROMMER. *Z. Metallkunde* 17, 145-50 (1925).—This is a theoretical discussion of the problems confronting the foundryman in the die casting of metallic alloys. Due to the fast cooling the cast material often reaches no state of equil. and may undergo aging. Stresses are set up and shrinkage cracks are apt to develop. The stresses are greatest just below the casting temp. and decrease as the temp. of the die and the casting approach each other. In castings of varying diam. the stresses are unevenly distributed and castings may even expand where the diam. is greatest. The tendency to form shrinkage cracks depends largely on the behavior of the material between the temp. at which the casting is discontinued and the temp. of removal of the casting from the die. For successful die casting it is necessary that when the casting is removed the hardness is sufficiently great and that either the shrinkage is practically nil (or negative) or the plasticity quite large. Of these two the plasticity is usually the determining factor since most alloys immediately after solidifying shrink considerably.

H. S. V. K.

X-ray evidence versus the amorphous-metal hypothesis. R. J. ANDERSON and J. T. NORTON. *Trans. Am. Inst. Min. Met. Eng.* (advance proof) Jan., 1925, 13 pp.—The effects of cold work, polishing and annealing on Al, Sn, Cu, Pb, Fe and some of their alloys have been examd. by taking X-ray diffraction patterns of the metals by 2 different methods. In all cases, even in metals that have been reduced 98% in cross-sectional area by cold work, characteristic cryst. diffraction patterns are obtained. Annealed metals give a pattern consisting of a series of broken lines; as the amt. of work done on the metal increases these lines become sharper and more continuous until, with severely worked metal, the pattern consists of sharp, solid bands formed by the overlapping of reflections from a great no. of at. planes oriented at suitable angles to the beam of rays. The polished surface of metals gives the same pattern as severely cold-worked metal, thus showing that the surface layer consists of innumerable sub-microscopic, cryst. fragments and not of amorphous metal, which should give simply black bands in the diffraction patterns.

B. C. A.

The temperature coefficients of the electric resistance of manganin and of constantan. S. ZHEMCHUZHNIK and S. POGODIN. *Ann. inst. anal. phys.-chim.* (Russ.) 2, 464-72 (1924); *Chem. Zentr.* 1925, I, 1237.—The temp. coeff. α of the resistance ρ of a metal can be ascertained directly from the relation: $\alpha = (\rho_{t_2} - \rho_{t_1}) / [\rho_{t_1}(t_2 - t_1)]$, regardless of the expansion of the metal. If, however, the sp. resistance is desired, the true temp. coeff. $\alpha_1 = \alpha + [1 + \alpha(t_2 - t_1)]\beta$ must be used. The correction depends upon the magnitude of α . Expts. are described which deal with the effect of annealing on the values ρ and α for manganin and for constantan alloys. The latter are much less susceptible to annealing than manganin alloys.

C. C. DAVIS

The influence of the time factor on tensile tests conducted at elevated temperatures. J. S. BROWN. *J. Inst. Metals* 1925 (preprint, 17 pp.).

E. J. C.

Increase in strength of single crystals by alloying and cold-drawing. P. ROSBAUD and F. SCHMID. *Z. Physik* 32, 197-225 (1925).—The rigidity of metallic crystals is expressed quantitatively by the shearing force in the plane of slip which is necessary to produce plastic change of shape. The crit. value is independent of such force as may be perpendicular to the plane; for Zn contg. 0.03% of Cd at the ordinary temp. it is 94 g./sq. mm. Single crystals of Zn contg. 0.53% of Cd show 9 times the strength, with 1.03% of Cd 12.2 times; extrapolating for pure Zn the value 40 g./sq. mm. is obtained. Zn contg. more than 0.1% of Sn solidifies with inclusions of Zn-Sn eutectic; with 0.5% of this eutectic the strength is 3 times that of the crystal free from Sn. The increase of strength produced by cold-drawing the Zn-Cd crystals rises with increase of the Cd content. Photomicrographs are reproduced.

B. C. A.

Case-hardening special steels without distortion by means of nitrogen. A. FRY. *Kruppsche Monatsh.* 5, 266-9 (1924).—Special steels may be case-hardened by heating

them at 580° in an atm. of N which slowly diffuses into the outer layers of the metal, forming nitrides. The advantages of this process over carburizing case-hardening are that quenching is unnecessary, the surface remains clean and no distortion, cracking, or subsequent changes due to aging take place. Highly polished and finished articles may be case-hardened by this process without deterioration, so that their edges and corners will scratch glass or even quartz, but sharp edges should, as far as possible, be avoided as the hardening process makes the surface layers brittle. B. C. A.

Contemporary heat-treating practice. C. B. BELLIS. *Trans. Am. Soc. Steel Treating* 8, 241-9 (1925).—A description of the hardening rooms of several plants in eastern U. S. W. A. MUDGE

Metallographic heat etching. F. SAUERWALD, W. SCHULTZE AND G. JACKWIRTH. *Z. anorg. allgem. Chem.* 140, 384-90 (1924).—Annealing polished metallic specimens in a vacuum develops the grain structure in the same way as "heat etching" them in a fused salt bath or in an indifferent gas, showing that the "etching" is not due to chem. action, but to recrystn. phenomena on the surface of the specimen and to vol. changes during heating. The characteristic double network that often develops during "heat etching" is due, not to polymorphic changes, but to this surface recrystn., which is induced by the cold work the specimen has undergone during polishing. Tests carried out on steels by heating in a vacuum indicate that the grain structure of the stable phase at high temps. can be detd. by slow cooling only when the compn. of the steel is near the eutectoid point and that, in other cases, quenching is essential for the development of the grain structure. B. C. A.

Nature of the Martensitic structure [of steel]. F. SAUERWALD AND G. JACKWIRTH. *Z. anorg. allgem. Chem.* 140, 391-8 (1924).—By the method already outlined (cf. preceding abstr.), it is shown that the martensitic structure of steel is always oriented in the same way as the original γ -grain boundaries and that the slip planes are similarly oriented. It would therefore appear that the needle-like structure of martensite is caused by slip phenomena induced by the hardening process (quenching) the steel has undergone and that martensite cannot be regarded as a distinctive phase in the structure of steel. B. C. A.

Fuels and furnaces for heat treating. W. TRINKS. *Trans. Am. Soc. Steel Treating* 8, 58-83 (1925).—An article selected primarily for its educational and informational character as distinguished from reports of investigation and research. W. A. M.

Equipment for heat-treating machine tool parts. D. M. GURNEY. *Trans. Am. Soc. Steel Treating* 8, 84-94 (1925).—A description of the layout and heat-treating equipment in use by one of the largest producers of semi-automatic lathe tools. W. A. M.

Determination of furnace efficiencies and heat-treating costs. C. L. IPSEN. *Trans. Am. Soc. Steel Treating* 8, 36-47 (1925).—The efficiency of the furnace must be based on the operating cycle; an elec. furnace will give from 33-78% efficiency depending upon the cycle and the material to be tested. W. A. MUDGE

The corrosion of certain metals by carbon tetrachloride. F. H. RHODES AND J. T. CARTY. *Ind. Eng. Chem.* 17, 909-11 (1925).—Ni is the most resistant of the dozen metals tested in cold CCl_4 both wet and dry. Sn is the most resistant to the wet vapor. Dry CCl_4 reacts with Al to form AlCl_3 and hexachloroethane. When brasses corrode in the damp vapor of CCl_4 the Cr appears as new crystals normal to the metal surface. E. L. CHAPPELL

Corrosion of cold-drawn steel in various concentrations of sulfuric acid. DELBART. *Compt. rend.* 180, 1942-3 (1925).—The corrosion in H_2SO_4 of hard and soft steels and steels contg. Mn and Si was studied with the samples both hard and annealed. Annealing above 700° gave min. corrosion in dil. acid and max. corrosion in oleum. The corrosion in 2% H_2SO_4 was about 600 times that in concd. E. L. CHAPPELL

Corrosion of α - β brass as affected by grain size. R. J. ANDERSON AND S. H. BROOKS. *Mech. Eng.* 47, 643-5 (1925).—Brasses with grain diams. 0.01 mm. to 0.10 mm. were made anodes in dil. acid, NaCl soln., tap water, etc. Corrosion varied with the soln. but was independent of grain size. Cf. C. A. 18, 3595. E. L. C.

Corrosion phenomena of aluminium. E. MAASS AND W. WIEDERHOLT. *Z. Metallkunde* 17, 115-21 (1925).—Samples of Al contg. 0.60% Fe and 0.54% Si were placed in 0.1 N HCl, HNO_3 , H_2SO_4 , $\text{H}_2\text{C}_2\text{O}_4$, HOAc and tartaric acid for 15 weeks and showed decreasing attack in the order given. The rate of attack is not proportional to the H-ion concn but is related to the rate of diffusion of the acid through the corresponding film of corrosion product. With alkalis a rapid initial attack was observed with the dil. hydroxides of K, Na, Ca and Ba, but action decreased after 2 to 3 days because of formation of a protective film of Fe and Si salts. A current of 0.015 milliamp. per cm^2 passed between Al electrodes in cond. water for 6 days caused first cor-

rosion but later built a protective film. Of the common salts of K, Na, NH_4 , Ca, Mg the chlorides are the most corrosive and cause pitting. The carbonates of K and Na are corrosive because of their high alkali. Little corrosion was observed in cond. water under air or H_2 . H_2O_2 attacks Al rapidly with pitting. E. L. CHAPPEL.

Corrosion of welded aluminium sheets. H. RÖHRIG. *Z. Metallkunde* 17, 198-9 (1925).—A series of corrosion tests on welded Al and alloys of Al-Cu (3% Cu) sheets was carried out in boiling 2-3% brine, which contained CaSO_4 , colloidal silicic acid and Ca and Mg bicarbonates. After 72 hrs., the sheets of 99.5% purity Al welded by oxy-acetylene lost 0.11%; those of 98-99% Al lost 0.14%; while those of Al-Cu alloy lost 0.43 and 0.86%. Similar sheets made by hammering out the metal lost 0.09, 0.08 and 0.21%, resp., for the 99.5% Al—the 98-99% Al and the alloy. The greatest corrosion in the oxy-acetylene welded sheets occurred where recrystn. had not taken place. In the sheets obtained by hammer welding, the little corrosion that occurred was evenly distributed. J. H. PERRY.

Corrosion of cast iron by tap water (Buenos Aires). C. F. HICKETHIER. *Anal. quim. Argentina* 11, 369-86 (1924).—No very marked differences in corrosive action were observed between the solns. of the different salts, distd. water and tap water. The water of the Rio de la Plata, though generally similar in compn. to tap water, exerts a smaller corrosive action. B. C. A.

Corrosion of copper alloys in sea water. W. H. BASSETT AND C. H. DAVIS. *Trans. Am. Inst. Min. Met. Eng.* (advance proof) Jan., 1925, 30 pp.—The results are recorded in tabular form of a large no. of corrosion tests, extending over a period of 10 years, of Cu alloys contg. Zn, Sn, Ni and Al in sea water. Of the Cu-Zn alloys tested those contg. 70-85% Cu resist corrosion better than any others; Muntz metal, pure Cu and Cu contg. up to 10% Zn corrode very rapidly, as the scale formed is crumbly and non-adherent. Cu-Ni alloys lose weight more rapidly than the best brasses, the scale having a great tendency to flake off, especially if allowed to become dry; German silver contg. 57% Cu, 28% Zn and 15% Ni compared favorably with 70:30 brass as regards loss in weight and tenacity of scale. The resistance of bronzes to corrosion by sea water increases with the Sn content, but bronzes are not so resistant as the best brasses, while Al-bronzes after the first few months corrode rapidly, with severe pitting and the formation of masses of loose, spongy scale. Addn. of Sn to β -brass increases considerably its resistance to corrosion, but tinning the surface of 70:30 brass causes severe dezincification and rapid failure of the alloy. The authors recommend that, instead of tinning condenser tubes, they should be finished by annealing at 650° for 30 min., then given a 10% reduction to produce a more highly finished surface, which is more resistant to sea water. B. C. A.

Corrosion relations at different temperatures of iron and steel alloys which have been known up to the present time as non-rusting. ALFRED BRUNNER. *Vierteljahrsschr. naturforsch. Ges. Zurich* 69, Beiblatt No. 6, 1-79 (1924). *Chem. Zentr.* 1925, I, 1197-8.—A study of the action of chem. reagents on various types of steel at room temp., at 60-80°, and at 400°. The most important fact detd. was that the greatest resistance to corrosion is possessed by highly alloyed steels contg. 4 components. Furthermore Cr steels with at least 11% Cr and a low C content (below 0.2%) are practically as resistant. With increase in the % Cr or with the introduction of Ni the resistance increases still more. In contrast to the Cr steels, pure Ni steels are easily attacked. Spring water, SO_2 , dil. HNO_3 and org. acids such as HOAc, malic, citric and lactic acids attack Ni steels more readily than Cr steels. Krupp V2A steel was the only one found which was resistant to org. acids and to SO_2 . Ni steels are more resistant to H_2SO_4 . No definite relations could be detd., for the individual types of steels showed great variations which could not be correlated with their compn. At boiling temp. they often are easily corroded if air is brought in contact with the surface simultaneously with treatment with salt or acid solns. Contact expts. involving Cr-Fe and Cr-Ni-Fe alloys in salt solns. with ordinary steels showed that the former are resistant to corrosion at the expense of the latter. For proof against rusting it is important that there be heat treatment before or after working. Small variations may greatly impair the resistance to rusting, and furthermore polishing is of importance. The resistance to rusting decreases when the alloy becomes tarnished. Technical applications of non-rusting steels and highly alloyed Si-castings included machines and equipment which are exposed to high temps. and where there is no possibility of condensation on the polished surface. If the latter is the case, then such alloys can be exposed even to strongly acid vapors. If they condense on the surface, however, only Krupp V2A steel is suitable. With the exception of V2A steel, it is important whether const. or periodic exposure to chemicals is involved. C. C. DAVIS

Avoiding the effects of corrosion on buildings and apparatus. W. S. CALCOTT. *Chem. Met. Eng.* **32**, 685-7(1925).—Structural steel must be protected by concrete or painting from contact with corrosive materials. A discussion is given of materials and design for the handling of corrosive chemicals.

Corrosion by city gas. C. H. S. TUPHOLME. *Iron Age* **116**, 738(1925).—English gas companies tested the corrosion of wrought Fe and steel pipes carrying CO_2 , O_2 and mixts. of the two. Such gases satd. with water vapor caused no corrosion, but when supersatd. by a steam jet rapid rusting occurred. The wrought Fe supplied was mixed with steel in several cases. Such mixts. are less resistant to corrosion than either material alone.

Oxidation of metal hulls and method of protecting them from rust. H. MASSEILLE. *Peintures, pigments, vernis* **1**, No. 3, 3-6; No. 4, 3-6(1924), *Chimie et industrie* **14**, 96(1925); cf. *C. A.* **19**, 2137.—A discussion of the causes of oxidation of metals immersed in water, more particularly of electrolytic action which is favored by lack of homogeneity of the metal, or by the presence nearby of a different metal. Movement of the propellers also accelerated corrosion of the shaft and of the stern of the ship.

A recent development in rustproofing. L. F. HIRSCH. *Elec. World* **86**, 622(1925).—A condensed report of the Nat. Bur. of Underwriters indicates that by the "Udylite" process (treating the surface with Cd and alloying it with the metal) no rust appeared after exposure to a salt spray test for 1860 hrs.; with Zn plating, rust appeared in 316 hrs.; with hot galvanizing in 650 hrs. and with sherardizing in 367 hrs.

The oxy-acetylene welding of copper. C. S. SMITH. *Metal Ind.* (N. Y.) **23**, 360-1(1925).

Crystal structure of Cu-Mn alloys (PATTERSON) **2**. Deterioration of structures in sea water (ANON.) **20**. Furnace heating (SARJANT) **21**. Use of liquid air in mine explosives and for welding and cutting metals (HERPIN) **24**. Dissociation of producer gas in the heat exchangers of open-hearth furnaces (GUYOT) **21**. Critical discussion dealing with CO , CO_2 and H_2 —application to blast furnaces (THIBEAU) **2**. X-ray investigation of some alloys (SACKLOWSKI) **2**. Measurement of electrical anisotropy in a metal sheet rolled in one direction (BECKER, BORN) **2**. Elastic properties of metallic mixed crystals (SACHS, SAEFTEL) **2**. Ore briquets (Brit. pat 230,306) **21**.

Concentrating ores. H. H. SMITH. U. S. 1,551,588, Sept. 1. A ore pulp contg. oxidized Cu compds. or other non-floatable metalliferous particles is treated with a gaseous mixt. contg. both H_2S and CO_2 , to render these particles floatable and the ore pulp is then subjected to froth-flotation concn.

Treating ores. E. S. BERGLUND. Can. 252,904, Aug. 25, 1925. Sulfide ores contg. Zn and Pb are partially roasted, mixed with CaC_2 , CaO and C and heated to reducing temp.

Treating cuprififerous pyrites. F. CURTIUS & Co. Brit. 230,415, March 10, 1924. Residue from the burning of cuprififerous pyrites is divided (magnetically or otherwise) into portions some of which can be leached directly with H_2O or acid. Other portions may be subjected to a chloridizing roast or mixed with fresh pyrites for further burning.

Treating copper ore. P. W. NEVILL. U. S. 1,551,605, Sept. 1. A Cu ore pulp contg. ferrous salts is subjected to froth flotation in the presence of coal gas or other reducing gas which serves to prevent oxidation of the Cu cement and also to prevent formation of ferric salts.

Precipitating copper. B. H. BENNETTS. U. S. 1,552,020, Sept. 1. A soln. of CuSO_4 is treated with pulverized CaCO_3 to obtain a ppt. of CuCO_3 and CaSO_4 which may be shipped or stored for subsequent smelting.

Recovery of metals from wastes. CUIVRE NATIF. Brit. 230,471, March 7, 1924. Slags, workshop sweepings, slimes, etc., contg. metals such as Cu, Zn, Fe and Ni in the free state or as silicates are treated with dil. H_2SO_4 and fluorspar, with or without a small quantity of a nitrate or HNO_3 to dissolve the metal values for recovery.

Reduction of metals. W. B. HAMILTON and F. REID. Can. 252,607, Aug. 11, 1925. Chromite is reduced and the metal content sepd. from the ore by adding C to a molten slag contg. oxide of Si and the chromite to be reduced. In making Fe alloys, the Fe is melted, slag contg. oxide of Si and ore contg. the metal to be alloyed with the Fe, is formed thereon and a reducing agent for the oxide of Si is added.

Aluminium. C. E. PARSONS and S. PEACOCK. U. S. 1,551,615, Sept. 1. A fuel-fed furnace is charged with C, Na_2CO_3 or other salt which will supply Na oxide and Al_2O_3 and the charge is ignited to reduce the Na salt in the furnace, the operation being continued until the Na reduces the Al_2O_3 to Al.

- **Smelting tin or other "low volatile" metals.** J. H. GRAY. U. S. 1,552,143, Sept. 1. Heat is supplied for smelting Sn ore or melting Sn, brass or Zn or similar materials by holding electrodes above the charge and maintaining an arc between them while the charge is shielded from direct exposure to the arc.
- **Blast furnace operation.** S. B. SHELDON. U. S. 1,552,179, Sept. 1. Blast air under full working pressure is applied at the same time to a portion only of the periphery of the furnace, this portion changing throughout the process. This mode of blasting serves to facilitate equal blasting effects throughout the furnace cross-section. Cf. C. A. 19, 462.
- **Air control device for open-hearth furnaces.** G. L. DANFORTH, JR. U. S. 1,552,118, Sept. 1.
- **Iron and steel.** G. CONSTANT and A. BRUZAC. Can. 252,673, Aug. 18, 1923. Ore is crushed and washed to remove the gang and after drying is rapidly reduced in a closed vessel with a C-contg. reducing gas which carburizes the reduced metal. The charge is then transferred to a smelting furnace, without contact with the air, where it is fused by any ordinary method.
- **Annealing iron and steel.** H. W. IRWIN. U. S. 1,551,745, Sept. 1. Mech. features.
- **Coating iron and steel with zinc.** F. F. FOWLE and F. M. CRAPO. U. S. 1,552,040, Sept. 1. A coating of steel of relatively high C content is applied to Fe or low-C steel and a Zn coating is applied over the steel coating. The steel coating serves to secure the Zn coating more firmly.
- **Coating iron and steel with zinc.** F. M. CRAPO. U. S. 1,552,041, Sept. 1. The surface of Fe or steel is nitrogenized, *e. g.*, by treatment with hot NH_3 , before applying a coating of Zn, in order to render the Zn more firmly adherent. U. S. 1,552,042 specifies prepreg. Fe or low-C steel for Zn coating by carbonizing the surface of the article, *e. g.*, an ingot, so that when the Zn coating is applied it will adhere firmly.
- **Coating aluminium.** A. PACZ. U. S. 1,551,613, Sept. 1. Cleaned surfaces of Al articles are provided with a colored coating by use of a soln. formed from a 10% aq. NH_3 soln. to which is added an NH_4 salt and small amts. of ammoniacal compds. of Ag and other metals.
- **Alloy steel.** H. T. CHANDLER. U. S. 1,552,401, Sept. 1. A heat-treated alloy steel includes the usual ingredients with a further addition of less than 1% Zr which improves its properties especially for use as armor plate.
- **Iron alloy resistant to corrosion.** G. H. CHARLS. U. S. 1,551,937, Sept. 1. An alloy adapted for resisting high temps. comprises Fe together with Mo 0.05–0.20, Cr 3–25 and C "in an effective amt." not exceeding 0.20%. Cf. C. A. 19, 1849.
- **Smelting iron alloys.** F. GREINER. U. S. 1,551,554, Sept. 1. Ferroalloys contg. Si, Mn, P or other constituents with greater affinity for O than Fe has, in pieces of convenient size, are coated with lime or other inert material having a higher m. p. than the ferro-alloy, before charging into a smelting furnace.
- **Tungsten alloys.** R. HÄGREN and W. C. HERAEUS GES. Brit. 230,356, Aug. 21, 1924. (Addn. to Brit. 221,786, C. A. 19, 812.) Alloys for tipping metal articles with hard points comprise W together with Pt 10–15 and Ir, Os or Ru 1–3% and are made by melting the constituents in an elec. arc. in H₂ or other reducing gas, or by means of cathode rays.
- **Aluminium alloys.** T. HARADA. Brit. 230,326, June 12, 1924. See U. S. 1,546,657 (C. A. 19, 2806).
- **Alloy.** A. PACZ. Can. 249,838, May 19, 1925. An Fe alloy contg. 0.75–4% B has a tensile strength of 50,000 lb. per sq. in.
- **Composite articles of hard and soft metals.** N. H. ADAMS. U. S. 1,552,184, Sept. 1. A spot-welding electrode or other article is formed of particles of refractory metal, heated sufficiently to sinter the particles together into a porous mass and then impregnated with a more readily fusible metal such as Cu.
- **Drawing and rolling metals.** J. G. DE LATTRE and H. HARDY. Brit. 230,117, Sept. 4, 1923. Hard and soft metals such as Cu and Sn or Pb are used together to coat metals to be drawn with an "antifriction" alloy. The coating metals are deposited from solns. of their compds. Several examples of solns. are given.
- **Apparatus for sherardizing metal articles.** C. J. KIRK. U. S. 1,552,050, Sept. 1.
- **Coating furnace bars, etc., with aluminium.** UEBERSEE-METALL AKT.-GES. Brit. 230,096, Feb. 28, 1924. To prevent scorification of fire- and furnace-bars, grates, etc., they are coated with Al by successive spray coatings with an intermediate heating to about 800° and final heating to about 1000°.
- **Solder.** J. G. KELLY and H. HALL. U. S. 1,551,750, Sept. 1. A solder adapted

for use on Al and cast Fe comprises Zn 5-40, Cd 3-15 and Sn sufficient to make a total of 100 parts.

Carbon-feeding device for welding apparatus. A. A. KRAMER and A. M. GRIFFIN. U. S. 1,552,060, Sept. 1.

10—ORGANIC CHEMISTRY

CHAS. A. ROUILLER AND CLARENCE J. WEST

Acetylene derivatives. EDUARDO VITORIA. *Mem. acad. cien. Barcelona* 19, 171 (1925).— $(\text{CHBr})_2$, b_{49} 148°, $b_{65.5}$ 158°, from C_2H_2 and Br, gives, when added in small portions to NaOEt, 1,2-diethoxybromoethylene, $\text{EtOCH}:\text{CBrOEt}$ (or possibly the 1,1-isomer, $(\text{EtO})_2\text{C}:\text{CHBr}$), b_{32} 81°, b. 175-80° (partial decompn.), n_D^{18} 1.4966, d_{18} 1.391, mol. wt. in freezing C_6H_6 192.4-202.6 (the Meyer vapor d. method did not give concordant results owing to decompn.), oil of neutral reaction and ethereal penetrating odor, strongly lachrymatory, fumes in contact with moisture with liberation of HBr, and development of a very disagreeable odor, energetically absorbs Br in the cold without appreciable evolution of HBr both in diffuse daylight and in artificial light, reacts slowly with cold, vigorously with hot aq. KOH, likewise with metallic Na; all its derivs. have a penetrating odor and are lachrymatory. C. A. R.

General method of synthesis of allylated derivatives. LÉONCE BERT. *Bull. soc. chim.* 37, 879-81 (1925).—See C. A. 19, 2644. $\text{C}_{11}\text{H}_{17}\text{O}$ in second line, p. 2645, should be $\text{C}_{11}\text{H}_{14}\text{O}$. This article is less comprehensive than the other one.

M. W. MCPHERSON

Catalytic action. XVI. A new synthesis of nitriles. TOHORU HARA AND SHIGERU KOMATSU. *Mem. Coll. Sci. Kyoto Imp. Univ.* 8A, 241-6 (1925); cf. C. A. 19, 2590.—iso-AmOH and NH_3 , passed over heated reduced Cu at 300-50°, give 83% of iso- $\text{C}_6\text{H}_5\text{N}$, d_4^{25} 0.7861; n_D^{25} 1.3850. A Cu prep'd. from CuO obtained from CuSO_4 and excess NaOH gave 58%, while that from the ignition of $\text{Cu}(\text{NO}_3)_2$ gave 48%. There also result in this reaction some hydrocarbons, aldehyde and basic compds. PhCH_2OH gave 84-4% of PhCN ; EtOH gave 39% MeCN; PrOH, 86% of EtCN; iso-BuOH, 81% iso-PrCN. The reaction probably proceeds through the aldehyde and amine.

C. J. WEST

β,β' -Dichloro- and β,β' -dibromodiethyl selenides and their simple halogen derivatives. H. C. BELL AND C. S. GIBSON. *J. Chem. Soc.* 127, 1877-84 (1925); cf. Bausor, Gibson and Pope, C. A. 15, 826; Heath and Semon, C. A. 15, 35; Boord and Cope, C. A. 16, 1560.— $(\text{ClCH}_2\text{CH}_2)_2\text{SeCl}_2$ is obtained almost quant. by the interaction of Se_2Cl_2 and C_2H_4 (B., G. and P.) but is more conveniently prep'd. without danger of contamination with Se, from SeCl_4 and C_2H_4 ; it m. 122.5°, mol. wt. in freezing C_2Cl_6 , 276; its aq. soln. decomp. above 35°, rapidly when boiled; it is quant. recovered from H_2O by addn. of concd. HCl. HBr, added to the dichloride (I) in cold H_2O gives the dibromide (II), m. 117° (decompn.). The corresponding dihydroxide or oxide could not be obtained. β,β' -Dibromodiethyl selenide dibromide, bright yellow, m. 118°. Reduction of I or II with H_2S , SO_2 or with KHSO_3 gives $(\text{ClCH}_2\text{CH}_2)_2\text{Se}$, m. 24.2°, mol. wt. in freezing C_6H_6 , 196. With Cl or Br it yields I or II. Se_2Cl_2 gives I quant. The only product of the oxidation with HNO_3 thus far isolated is I. β,β' -Dibromodiethyl selenide, yellow, m. 44.2°; with Cl it yields the dichloride, pale yellow, m. 98-9°, also obtained from the dibromide and concd. HCl.

C. J. WEST

The formation of hydrazine, hydroxylamine and aniline from hydrazoic acid. K. F. SCHMIDT. *Acta Acad. Aboensis Math. et Phys.* 2, 38 pp. (1924); *Chem. Zentr.* 1925, I, 1572-3.—Anhyd. HN_3 is according to Curtius decomp'd. by concd. H_2SO_4 with evolution of gas. Expts. by S., in which NaN_3 was treated with concd. H_2SO_4 , showed that the reaction began at 30°. It consisted of oxidation by H_2SO_4 with formation of N_2 , H_2O and SO_2 . In addn. to this, NH_2OH was formed in an amt. corresponding to $1/7$ of that represented by the reaction: $\text{HN}_3 + \text{H}_2\text{O} \longrightarrow \text{N}_2 + \text{NH}_2\text{OH}$. It is assumed that the HN_3 is decomp'd. by H_2SO_4 into N_2 and $>\text{NH}$ and that the greater part of the $>\text{NH}$ is oxidized by H_2SO_4 to N , a smaller part, however, combining with the H_2O formed by reduction of the H_2SO_4 to form NH_2OH . Dil. H_2SO_4 or gaseous HCl acts in a different manner on HN_3 , the reaction $3\text{HN}_3 + \text{HCl} \longrightarrow \text{NH}_4\text{Cl} + 4\text{N}_2$ proceeding at a slow rate. If NH_3 is heated in soln., e. g., in C_6H_6 , in the absence of an acid, a similar decompn. occurs, whereby the role of the HCl is assumed by extra HN_3 , thus: $4\text{HN}_3 \longrightarrow \text{NH}_4\text{N}_3 + 4\text{N}_2$. This reaction is, however, slower, for a 4% soln. of HN_3 in C_6H_6 forms no NH_3 after 10 hrs. at 150° and even after 48 hrs. at 230° only $1/4$ of

the HN_3 is decompd. If, however, HN_3 in C_6H_6 is let stand with concd. H_2SO_4 at 15° as 2 strata, gas is evolved steadily for 5–6 days, and at $60\text{--}70^\circ$ with agitation, the evolution of gas is complete in 5 hrs. In both cases the quantity of N is about 85% of the N content of the original material, different as are the rates of the reactions. In the expt. at 15° N_2H_4 , H_2SO_4 sepd. in the H_2SO_4 layer, besides which PhNH_2 and NH_2OH were formed. In the expt. at $60\text{--}70^\circ$ only a small amt. of H_2NNH_2 was formed, but a large amt. of PhNH_2 . In the C_6H_6 soln. no product except SO_2 was detected. Only a trace at the most of NH_3 was formed in either case. The HN_3 soln. was prepd. by decompn. of cold satd. aq. NaN_3 by 50% H_2SO_4 and extn. with pure C_6H_6 . Ninety % of the HN_3 is extd. by the C_6H_6 , alkalimetric detns. showing about a 4% soln. of HN_3 in C_6H_6 . The N evolved entrains only a little HN_3 , which can be detd. in NaOH , as well as the SO_2 . The N is measured. By diln. of the H_2SO_4 layer with ice and Et_2O , N_2H_4 , H_2SO_4 can be quant. recovered and weighed, with a control weighing as benzalazine. From the filtrate after removal of the H_2SO_4 , PhNH_2 is isolated by alk. extn. with Et_2O and evapn. of the Et_2O ext. with HCl , leaving NH_2OH , HCl , which is weighed and the N detd. as an indication of its purity. The formation of PhNH_2 is explained by the reaction: $\text{HN}_3 \rightarrow \text{N}_2 + >\text{NH}$; the latter then forming PhNH_2 thus: $>\text{NH} + \text{C}_6\text{H}_6 \rightarrow \text{PhNH}_2$, the reactions corresponding to the formation of sulfonamides from sulfone azides and hydrocarbons where an intermediate radical $\text{R} \cdot \text{SO}_2\text{N} \cdot$ also appears. That the formation of PhNH_2 is favored by heat is indicated by the small tendency when hot for the radical $>\text{NH}$ to combine to form diimides and on the easier sensitivity to attack of the C_6H_6 . The part played by $>\text{NH}$ is particularly evident when it is treated with substances which form addn. compds. easily. Thus when HN_3 in C_6H_6 is treated with Ph_2CO or with $m\text{-O}_2\text{NC}_6\text{H}_4\text{CHO}$ and then in the cold. with a little concd. H_2SO_4 , a violent reaction immediately sets in. With Ph_2CO a quant. yield of BzNHPH is formed according to the Beckmann transformation of the $\text{Ph}_2\text{C}:\text{NOH}$ formed initially from the Ph_2CO and $>\text{NH}$. With $m\text{-O}_2\text{NC}_6\text{H}_4\text{CHO}$ $5/6$ of the theoretical yield of $m\text{-O}_2\text{NC}_6\text{H}_4\text{CN}$ is formed with sepn. of H_2O from the oxime, and $1/6$ of $m\text{-O}_2\text{NC}_6\text{H}_4\text{NH}_2$ with liberation of CO . The total yield is not quite quant. It can be assumed that the formation of N_2H_4 at 15° takes place with the aid of C_6H_6 , since it takes place only in C_6H_6 : $2\text{HN}_3 \rightarrow 2\text{N}_2 + 2\text{NH} < ; 2\text{HN} < + 2\text{H}$ (from C_6H_6) $\rightarrow \text{N}_2\text{H}_4$. A similar reaction has been observed with sulfonazides, where the hydrocarbons were coupled to form "antibodies" with loss of H. But in expts. by S. no such antibodies were obtained, and the quantity of N_2H_4 was less than that required by the theory above, and was, taking into account the by-products (NH_2OH , PhNH_2), never greater than that corresponding to the reactions: $4\text{HN}_3 \rightarrow 4\text{N}_2 + 4\text{HN} < ; 4\text{HN} < \rightarrow 2\text{HN}:\text{NH}$; $2\text{HN}:\text{NH} \rightarrow \text{N}_2 + \text{N}_2\text{H}_4$. The primary reaction with H_2SO_4 involves also in every case the formation of N_2 and $\text{HN} <$. Under suitable conditions the $\text{HN} <$ attacks the solvent (C_6H_6 when hot, ketones when cold), under other conditions it polymerizes to diimides which immediately are transformed to N and H_2NNH_2 . The formation of NH_2OH at 15° on the contrary may occur in the H_2SO_4 layer, as in the expt. with H_2SO_4 in the absence of C_6H_6 . Here too $\text{HN} <$ plays a part as an intermediate product.

C. C. DAVIS

Peramidiosulfonic acid. F. SOMMER, O. F. SCHULZ AND M. NASSAU, *Z. anorg. allgem. Chem.* 147, 142–55 (1925).—*Hydroxylamine-iso-monosulfonic acid*, called *peramidiosulfonic acid* (I), $\text{SO}_2(\text{OH})(\text{ONH}_2)$, for short, is prepd. as follows: 30 cc. ClSO_3H is added slowly to 13 g. $(\text{NH}_2\text{OH})_2 \cdot \text{H}_2\text{SO}_4$. I is pptd. on warming to 100° and is then allowed to cool in a desiccator, introduced carefully into ice-cold dry Et_2O , filtered, washed with dry Et_2O and finally placed in a P_2O_5 desiccator. Prcpd. in this way, I contains only traces of Cl and SO_4 . For additional purification it is dissolved in MeOH , filtered, and pptd. in fine crystals by addn. of 2 vols. of CHCl_3 . The I must be kept in a desiccator as it easily goes over into $\text{NH}_2\text{OH} \cdot \text{H}_2\text{SO}_4$. It possesses strong oxidizing properties, liberating I from KI, and showing 14.16% active O. Detns. of the hydrolysis velocity showed 5% decompn. of a 20% soln. in H_2O at 0° after 24 hrs., and 25% decompn. after 8 days. Its alkali salts are dissociated much more rapidly, the Na salt showing 23% hydrolysis at 0° after 24 hrs. I gives the following reactions: (1) EtOH forms *ethylhydroxylamine sulfuric acid*. (2) $\text{C}_6\text{H}_5\text{OH}$ forms *p-toluenesulfonic acid hydroxylamine*. (3) With aldehydes and ketones the *oximesulfonic acids*, previously unknown, are formed and isolated as K salts. They are prepd. by adding to I in a little ice H_2O equiv. quantities of the aldehyde or ketone and KOH . The yield is good and the salt is recrystd. from hot alc. These salts also possess strong oxidizing properties and are quite stable. Acids, however, decomp. them with formation of a nitrile and the sulfate: $\text{RCH}:\text{NOSO}_3\text{K} \rightarrow \text{RC}:\text{N} + \text{KHSO}_4$. (4) I is decompd. by alkalis as follows: $2\text{I} + 6\text{KOH} = 3\text{K}_2\text{SO}_4 + 6\text{H}_2\text{O} + \text{NH}_3 + \text{N}_2$. The reaction is sometimes explosive. Similar behavior is also shown by salts of quite weak bases. These

reactions are discussed in detail. (5) I is useful in amine and hydrazine syntheses. Thus ethylenediamine is converted into the previously unknown 1-hydrazino-2-aminoethane in the form of the dioxalate; 50 cc. of 10% aq. (CH_2NH_2), 9.3 g. K_2CO_3 in 200 cc. H_2O and 9.4 g. I in a little ice H_2O , are heated to boiling under a reflux condenser. The soln. is acidified with AcOH, evapd. to $\frac{1}{3}$ its vol., and sepd. from the great mass of K salts by filtration. Then 5 g. BzH is added at 50° , the oily hydrazone extd. with Et_2O , and after addn. of 7.5 g. $\text{H}_2\text{C}_2\text{O}_4$ and a little boneblack, the soln. is steam distd. until no more aldehyde goes over. On cooling the filtered soln., the crude dioxalate seps. and crysts. from hot H_2O in rosetts of birefringent needles, m. 204° , having the formula: $\text{NH}_2\text{CH}_2\text{CH}_2\text{NHNH}_2 \cdot 2\text{C}_2\text{H}_2\text{O}_4$ (II). II is used in the prepn. of other salts of this base, such as the *dipicrate*, yellow, m. 166° (decompn.), or the *dichloride*, melts 165 – 166° , decomp. 200 – 5° . With BzH, II gives 1-benzalhydrasino-2-aminoethane oxalate, $\text{H}_2\text{C}_2\text{O}_4 \cdot \text{NH}_2\text{CH}_2\text{CH}_2\text{NHNH}:\text{HCPh}$, m. 150 – 2° (decompn.). An analogous compd. is formed with salicylaldehyde. These aldehyde compds. reduce Fehling soln. in the cold on long standing. On heating with H_2O , the aldehyde is given off, and the product reduces Fehling soln. quickly in the cold. The aldehyde compds. decomp. in solid form in moist air. (6) If I is treated with 50 equivs. of NH_4OH hydrazine is formed (yield 50%). With only 5 mols. of NH_4OH per mol. of I, the yield is 0 at 0° , 27% at 100° , while with 10 mols. it is 3% at 0° , 40% at 100° . Above 10 mols., temp. has little effect. The authors believe that I can be used in obtaining triazene derivs., but have not as yet established that fact.

H. STOERTZ

β -Chlorovinylarsines and their derivatives. W. LEE LEWIS AND H. W. STIEGLER. *J. Am. Chem. Soc.* 47, 2546–56 (1925).—If the previously published mechanism of the reaction between AsCl_3 , AlCl_3 and C_2H_2 (*C. A.* 17, 1421) is correct, then AsBr_3 should yield bromo-arsines, which it does, while AlBr_3 should not affect the reaction, which is also true. β -Bromovinylidibromoarsine, b_{16} 140 – 3° , from AsBr_3 , AlCl_3 and C_2H_2 ; oxidation gives β -bromovinylarsonic acid, m. 143° and 130° (2 forms). *Bis*-[β -bromovinyl]-bromoarsine, b_{16} 155 – 65° . Thus the halogen on the As halide used in the reaction det. the halogen in the resulting org. As compd. $\text{ClCH} \cdot \text{CHAsCl}_2$ (I) with excess dil. NH_4OH gives β -chlorovinylarsenous oxide (II), m. 143° . I and KI in HI give β -chlorovinyl-diiodoarsine, yellow-brown, m. 37.5 – 8.5° . II and KBr in HBr give β -chlorovinylidibromoarsine, b_{16} 114 – 6° (yield, 92.5%). Oxidation of II with H_2O_2 or of I with HNO_3 gives β -chlorovinylarsonic acid, m. 130° , sepg. as needles from org. solvents or in a flat, hexagonal type from H_2O ; both forms are bi-axial, positive, orthorhombic, with α 1.555, β 1.565, γ 1.705. Ag salt, $\text{ClCH} \cdot \text{CHAs}(:\text{O})(\text{OAg})_2$, cryst., fairly stable to light when pure, decomp. violently on heating alone or with HNO_3 . Either I or II with H_2S gives the sulfide, Au-yellow oil, forming a clear amber plastic which cannot be distd. without decompn., has an extremely irritating and nauseating odor but no vesicant action. I and α - $\text{C}_{10}\text{H}_7\text{NHP}$ give 7- β -chlorovinyl-7,12-dihydro-7-benzophenarsazine, bright yellow, m. 213° . Ph_2NH gives 6- β -chlorovinylphenarsazine, green, m. 186 – 7° ; it is decidedly irritating to the eyes and nostrils. I and KCNS give β -chlorovinylhydroxythiocyanarsine, oily, rather unstable in air. *Bis*-[β -chlorovinyl]arsinous oxide, m. 62 – 3° . The arsenic acid, m. 114 – 5° . The yellow-brown viscous sulfide has a powerful, penetrating and disagreeable odor and an extremely irritating effect on the mucous membrane. The cyanide is an oil. *Bis*-[β -chlorovinyl]ethylarsine, oil, results from the chloride and EtMgI . MeI gives *bis*-[β -chlorovinyl]methylethylarsonium iodide, sublimes at 234° . *Bis*-[β -chlorovinyl]methylarsine, oil with a powerful, disagreeable odor. MeI gives the dimethylarsonium iodide, decomp. at 243° (probably into MeI and the arsine). *Bis*-[β -chlorovinyl]- α -naphthylarsine, yellow oil which could not be crystd. or fractionated at 25 mm. *Tris*-[β -chlorovinyl]arsine hydroxynitrate, m. 103° , from the arsine and HNO_3 . *Tris*-[β -chlorovinyl]methylarsonium iodide, m. 202° ; this gives a double salt with HgI_2 , m. 150 – 6° , and with PhIIgI , m. about 147 – 8° . *Tris*-[α -chlorovinyl]arsine and AgNO_3 form a double salt in mol. proportions, m. 144° and one with 2 mols. arsine to 1 AgNO_3 .

C. J. WEST

Dimethyltin group and some of its reactions. C. A. KRAUS AND W. N. GREER. *J. Am. Chem. Soc.* 47, 2568–75 (1925).—Dimethyltin dichloride, m. 107° . Me_2SnBr_2 in liquid NH_3 , treated with 4 at. equivs. of Na, gives di-Na dimethylstannide (I), giving a deep red soln. opaque at higher concns. With 3 Na, there results di-Na tetramethylstannoethane, $(\text{NaMe}_2\text{Sn})_2$, which forms a red soln. in liquid NH_3 . With MeI it yields $(\text{Me}_2\text{Sn})_2$. I and Me_2SnBr_2 give di-Na hexamethylstannopropane, orange-red in liquid NH_3 . EtBr gives di-Et hexamethylstannopropane, oily liquid, slowly oxidizing in the air; it distills with apparent decompn. With Me_3SnBr there is formed dodecamethylstannopentane, oily. I and CH_2Cl_2 in liquid NH_3 give the stagno-ethylene, $\text{Me}_2\text{Sn}:\text{CH}_2$, oily, which oxidizes slowly in the air and is reactive towards the halogens. Its prop-

erties undergo change with time, apparently due to polymerization. The mol. wt. in C_6H_6 indicates a high degree of polymerization. The free groups, *dimethyltin*, in the polymerized form, were prepd. from Me_2SnBr_2 and 2 Na in liquid NH_3 or from 1 and 1 mol. equiv. of Me_2SnBr_2 . Both products are yellow solids, insol. in org. and inorg. solvents and oxidizing readily, 1 being spontaneously inflammable. C. J. WEST

Problem of ring closure in addition compounds. II. Constitution of compounds of tin tetrachloride with polycarboxylic esters. WALTER HIEBER AND RENATUS BECKER. *Ann.* **444**, 249-55 (1925); cf. *C. A.* **19**, 50.— $C_2(CO_2Et)_4$ and $SnCl_4$ form compds. in the ratio of 2 ester-2 halide, 2 ester-3 halide and 2 ester-4 halide, all of which are rather hygroscopic and m. about 94-5°. $(CH_3)_2(CO_2Et)_4$ forms similar compds. which m. about 124° (decompn.). Tri-Et tricarballoylate forms compds. of 2 ester with 2 and 3 halides, the 1st m. 118°. The constitution of the compds. is discussed in the light of H.'s hypothesis. **Compounds of tin halides with isomeric diamines.** W. HIEBER AND ROBERT WAGNER. *Ibid* 256-65.—*Dianiline tin tetrachloride*, very stable, begins to decomp. 200°, the *tin tetrabromide compd.* decomp. 150°. *o-Phenylenediamine-tin tetrachloride*, pale rose, decomp. 230°; the corresponding $SnBr_4$ compd. decomp. slowly 180°: mol. wt. in $PhNO_2$: concn., 0.0148 mols., 384.7; 0.0243 mols., 466.9; calcd. 546.4. *m-C_6H_4(NH_2)_2* gives 2 compds.: 2 base-1 $SnCl_4$, yellowish, decomp. 180°, and 1 base-1 $SnCl_4$, pale rose. They are hydrolyzed by cold H_2O . *p-C_6H_4(NH_2)_2* also gives 2 compds. similar compn. with $SnCl_4$ and also $SnBr_4$. *(p-H_2NC_6H_4)_2* gives a compd. 1 base-1 $SnCl_4$, violet, darkens at 200° and 2 base-1 $SnCl_4$, grayish white, amorphous, slowly decomp. 220°. *o-H_2NC_6H_4CO_2Et* gives the compd. 2 ester-1 $SnCl_4$, decomp. 180°, and 2 ester-1 $SnBr_4$, pale yellow, decomp. 150°. The 2 *p-ester-SnCl_4 compd.* decomp. 190°. Constitutional formulas are discussed. C. J. WEST

Certain derivatives of pentadecylaldehyde. ST. LANDA. *Chem. Listy* **19**, 264-7 (1925).—Pentadecylaldehyde can be prepd. by heating hydroxypalmitic acid under reduced pressure. At 20-5 mm. the evolution of H_2O ceases at about 170° and CO evolution commences, the product b. 260-300°. It b. 172-6°, m. 24-5°, and easily polymerizes. The reaction for aldehydes with Fehling soln. was not detected, but the substance does react with Schiff reagent and with NH_4AgNO_3 . By treating the aldehyde in alc. with the appropriate azide, ppts. of the following derivs. are obtained: Thiosemicarbazone, $NH_2CSNHN:CH(CH_2)_{13}Me$, m. 95-6.5°. Semioxamazone $NH_2COCONHN:CH(CH_2)_{13}Me$, m. 200-1°. *p*-Bromophenylhydrazone, m. 40-50°. Methylphenylhydrazone $C_6H_5CH_3NN = CH(CH_2)_{13}CH_3$, m. 35°. Benzylphenylhydrazone, m. 51.5°. *p*-Nitrophenylhydrazone, m. 94-5°. 2,4-Dinitrophenylhydrazone, m. 107.5°. Pentadecylidenebenzoylhydrazine, m. 79-80.5°. Pentadecylidene-*m*-nitrobenzoylhydrazine, m. 102°. Methylphenyltetradecylthiopyrazolinethiol, $Me(CH_2)_{13}CH(S.C(SMe):N.NPh)$, results from the interaction of pentadecylaldehyde and Me phenylthiocarbazinate.

and Me phenylthiocarbazinate.

J. C. KRACEK

New method for the reduction of aldehydes and ketones. HANS MEERWEIN AND RUDOLF SCHMIDT. *Ann.* **444**, 221-38 (1925).—The method consists in the use of $Al(OEt)_3$ or $EtOMgCl$; $Mg(OEt)_2$ has little reducing action and $Ca(OEt)_2$ practically none. Methods are given for the prepn. of these ethylates and several examples of their use; the yields are usually 80-90%. The principal advantage of this new method is that it can be applied to unsatd. compds. without hydrogenation of the double bonds. The operation may be carried out at room temp., when it is complete after several days, at the b. pt. of $EtOH$ or in an indifferent solvent, such as $PhMe$. C. J. WEST

Esterification. B. V. BHIDE AND J. J. SUBBOROUGH. *J. Indian Inst. Sci.* **8A**, 89-127 (1925); cf. *C. A.* **17**, 3016.—The esterification const. of 46 acids at 25° in excess of anhyd. $EtOH$ with HCl as catalyst have been calcd. from Goldschmidt and Edby's formula, $k_d = (r + a) \log a / (a - a)$, where $r = 0.15$, as const. values cannot be obtained with the usual equation for a unimol. reaction on account of the disturbing action of the H_2O formed during the reaction. The values for k_1 given below have been recalcd. for 0.1 *N* HCl from the values for k_2 , on the assumption that the latter are proportional to the concn. of the catalyst. Below are, resp., the b. p. (pressure in parentheses) or m. p. and k_1 for the different acids: valeric, 180-1° (685), 0.268; caproic, 198-9° (685), 0.267; nonoic, 245-6° (685), 0.270; decolic, 148-50° (9), 0.269; lauric, 43-3.5° (685), 0.272; myristic, 53.5°, 0.269; palmitic, 61-2°, 0.276; stearic, 68.5-9.0°, 0.276; erucic, 32-2.5°, 0.279; brassidic, 58.5-9.0°, 0.273; allylactic, 184-5° (683), 0.274; hydrocinnamic, 47.5°, 0.321; isopropylacetic, 151-2° (683), 0.0518; isobutylacetic, 199-201° (683), 0.247; isoamylacetic, 205-7° (683), 0.267; methylpropylacetic, 190-1° (683), 0.0393; methylallylactic, 188-9° (683), 0.0421; methylbutylacetic, 203-5° (683), 0.0345; methylbenzylacetic, 150-2° (8), 0.0553; methylisopropylacetic, 184-6°

(683), 0.0110; methylisobutylacetic, 203.4° (683), 0.0318; ethylbutylacetic, 221-2° (683), 0.00283; dipropylacetic, 219-20° (683), 0.00285; cycloheptanecarboxylic, 137-9° (14), 0.0499; bicycloheptanecarboxylic, 97.5-8.0° (11), 0.0137; cyclohexylacetic, 230-1° (6C3), 0.0809; cyclohexeneacetic, 137-8° (11) (m. 36-7°), 0.108; cyclohexylidenecarboxylic, 91.5-2.0° (3), 0.00228; *p*-methylcyclohexylacetic, 71-2° (10), 0.0999; *p*-methylcyclohexeneacetic, 130-2° (10) (m. 39-40°), 0.118; *p*-methylcyclohexylidenecarboxylic, 62-3° (10), 0.00234; Δ^1 -tetrahydrobenzoic, 238-40° (683), 0.00220; Δ^2 -tetrahydrobenzoic, 130-2° (30), 0.0829; cycloheptatrienecarboxylic, 55-6° (10), 0.00184; *o*-toluic, 102°, 0.000718; *m*-toluic, 110°, 0.00261; *p*-toluic, 176-7° (10), 0.00197; hexahydro-*m*-toluic, 128-30° (11), 0.0827; hexahydro-*p*-toluic, 134-6° (15) (m. 110°), 0.0850; β -cyclohexylpropionic, 140-2° (10), 0.141; Δ^2 -cyclohexeneacetic, 125-7° (8), 0.0731; adipic, 149-50°, 0.301; pimelic, 103°, 0.282; suberic, 140°, 0.264; α -cyclogeranic, 93°, 0; β -cyclogeranic, 104.5°, 0. These results lead to the following generalizations. In the normal chain acids, *k* falls from AcOH to PrCO₂H and then remains practically const.; an olefin linking has little or no effect if sufficiently far removed from the CO₂H group (allylacetic, crotonic, brassidic). Effect of attaching a Me group to the penultimate C atom in normal fatty acids: introduction of Me into EtCO₂H reduces *k* from 0.550 to 0.156; into PrCO₂H from 0.270 to 0.0518; into BuCO₂H from 0.268 to 0.247; in AmCO₂H no effect is produced. The iso-Pr group exerts its max. inhibiting effect when introduced into AcOH. In the dialkylacetic acids, the Et has a greater inhibiting effect than the Me group, but Et, Pr, Bu, allyl and iso-Bu groups have practically the same effect; the iso-Pr has a greater retarding effect than the Pr and Bu groups, and the inhibiting effect of the PhCH₂ is less than that of the Et group. In the said dibasic acids, *k* increases to a max. with glutaric and then falls. The ease of esterification of the cycloparaffin monocarboxylic acids increases in the order 3-, 7-, 6-, 5- and 4-C atom rings; with the exception of the cyclopropane acids, they are esterified more readily than the corresponding open-chain acids. Reduction of the benzene ring produces a marked increase in *k* in BuCO₂H and the toluic acids but a large decrease in PhCH₂CO₂H and PhCH₂CH₂CO₂H. A *p*-Me group in cyclic acids usually produces an increase in *k* (except in BuCO₂H). A β , γ -olefin linkage has an accelerating, an α , β -double bond an inhibiting effect in the cyclic monobasic acids. *o*-Di-Me substituents in the cyclohexanecarboxylic acids, as in the BuOH series, have a marked inhibiting effect.

C. A. R.

Stability of additive compounds between esters and acids. JAMES KENDALL AND J. B. BOOGE. *J. Chem. Soc.* 127, 1768-77 (1925); cf. *C. A.* 10, 2715.—A study is made of the extent of the dissociation of certain typical ester-acid compds. into their components on fusion by comparing the f.-p. depression induced by the addn. of free ester, an inert solute (C₆H₆) and the active solute H₂O and the extent to which ester-acid compds. are still existent in a dil. soln., when the solvent is inert, by detg. the f.-p. depression curves of C₆H₆ on addn. of ester and of acid, separately and in company. The approx. degrees of dissociation are: AcOEt-Cl₃CCO₂H (m. -26.8°), 12%; BzOCH₂Ph-Cl₃CCO₂H (m. 13.6°), 35%; Me succinate-Cl₃CCO₂H (m. 8.3°) 4-6%; these values refer to different temps. (an unavoidable defect of the f.p. method employed) but the order of stability is in accordance with previous work. Changes in degree of dissociation with temp. are presumably small. The mol. heats of fusion of the 3 compds. are 5170, 5660 and 9600 cal., resp. In dil. C₆H₆ soln. (at temps. slightly above 0°) the compd. AcOEt-Cl₃CCO₂H is still markedly stable and the decomposition of such a weak complex as AcOEt-AcOH is not complete.

C. J. WEST

Additive compounds in the ternary system: ester-acid-water. JAMES KENDALL AND C. V. KING. *J. Chem. Soc.* 127, 1778-91 (1925).—For systems, AcOEt-HCl, AcOEt-Cl₃CCO₂H, AcOEt-CICH₂CO₂H and AcOEt-AcOH, are examd. in detail, with the idea of ascertaining how conditions vary when a representative ester is paired against a series of acids of widely divergent strength. F. p., sp. cond. and reaction velocity measurements are reported. AcOEt gives a "pseudo-ideal" f.-p. depression curve for H₂O and must consequently be extensively hydrated. The f.-p. depression caused by equiv. quantities of AcOEt and HCl taken together is greater than the sum of the depressions due to the 2 separately. It follows that ternary complexes and ester-acid additive compds. are not existent in significant quantity in H₂O. This conclusion is supported by sp. cond. data. Although the f.-p. depression curves obtained for Cl₃CCO₂H, CICH₂CO₂H and AcOH with AcOEt appear to indicate the survival of some ester-acid complex, yet the sp. cond. results in these systems also demonstrate decisively that no appreciable fraction actually persists. The f.-p. curves with these org. acids are presumably not strictly comparable, because of internal pressure and association changes. The sp. cond. of a neutral salt, as well as of an acid, in H₂O is lowered by the addn. of AcOEt. This lowering is due to diminished ionic mobilities.

The rate of hydrolysis of AcOEt in the presence of HCl in equiv. quantity increases more rapidly than the mol. concn. of the acid. With weaker acids, the rate of hydrolysis increases less rapidly. In fact, the curve for AcOH shows a max. rate near the satn. point. The soly. of EtOAc in H₂O at 0° varies very remarkably when electrolytes are also present in equiv. quantity. The rate of inversion of sucrose in HCl soln. at 0° is not affected by the addn. of AcOEt. Inasmuch as the rate of ester hydrolysis is greatly increased by the addn. of sucrose, it is clear that the mechanism of the 2 reactions must be fundamentally different. Although it has been demonstrated that ester-acid additive compds. and ternary complexes of these with H₂O do not exist in quantity in H₂O, yet this cannot be considered as proof that such compds. do not constitute intermediate steps in the reaction. An infinitesimal quantity of a compd. at any one time would suffice for this purpose, its very instability serving, indeed, as a potent factor in the catalysis. The min. extent to which these ester-acid compds. survive precludes further study of them by the f.-p. depression method but valuable results are promised from a more intensive study of compds. of the type ester-H₂O.

C. J. WEST

Hydrolysis of the amides of α,β -unsaturated acids and of their saturated analogs. A. R. YATHIRAJA AND J. J. SUDBOROUGH. *J. Indian Inst. Sci.* **8A**, 55-69 (1925).—It has been shown (C. A. **6**, 1154 and earlier papers) that α,β -unsatd. monobasic acids are esterified by the catalytic process much more slowly than the corresponding satd. acids and similarly that their Et esters are less readily hydrolyzed by dil. HCl or Ba(OH)₂, and Y. and S. now find a similar relation in the velocity of hydrolysis of their amides by NaOH and dil. H₂SO₄, the hydrolysis consts. at 100° of PrCONH₂, MeCH:CHCONH₂, PhCH₂CH₂CONH₂ and PhCH:CHCONH₂ with NaOH being 0.111, 0.0697, 0.172, 0.0511, resp., and with H₂SO₄ 0.0888, 0.00980, 0.0837, 0.00748. The amts. of amide hydrolyzed were detd. essentially by the method of Remsen and Reid (*Am. Chem. J.* **21**, 281 (1899)); the hypobromite method (Peskov and Meyer, *C. A.* **7**, 1652) gives much the same although on the whole slightly lower values. The numerical data are given in full.

C. A. R.

The configurational relationships between α -hydroxy acids and β -hydroxy acids and between the latter and secondary alcohols. P. A. LEVENE AND H. L. HALLER. *J. Biol. Chem.* **65**, 49-53 (1925).—It is proposed to study the relation between β -HO acids, α -HO acids and the secondary alcs. by means of the reactions RCH(OH)CH₂-CO₂Et \rightarrow RCH(OH)CH₂NH₂ \rightarrow RCH(OH)CH₂OH \rightarrow RCH(OH)CO₂H; RCH-(OH)CH₂NH₂ \rightarrow RCH(OH)CH₂Cl \rightarrow RCH(OH)CH₂CH₂CO₂H \rightarrow RCH(OH)-Et; RCH(OH)CH₂Cl \rightarrow RCH(OH)Me. *Levo-3-hydroxybutyric acid* (*J. Chem. Soc.* **81**, 1402 (1902)) [α]_D²⁵ -24.5°, in H₂O. *Me Levo-3-hydroxybutyrate* (cf. Fischer and Scheibler, *C. A.* **3**, 2135), b₁₇ 70-2°, [α]_D²⁰ -20.9°, without solvent. *Neo-3-hydroxybutyrylhydrazide*, C₇H₁₀O₂N₂, m. 129-30°, [α]_D³¹ -29.3°, in EtOH. *Sym-Dextro-2-hydroxypropylurea*, C₇H₁₀O₃N₂, [α]_D²⁵ 18.5°. *Levo-2-hydroxypropylamine-HCl*, C₃H₁₀ONCl, [α]_D^{25.5} -31.2°, in H₂O, much less in N NaOH, (the last 3 substances were prepd. according to methods of Levene and Scheidegger, *C. A.* **19**, 1128, for inactive compds.). *Levo-1,2-dihydroxypropane*, from the amine, AgNO₂ and HCl.

I. GREENWALD

Complex salts of ethylenebis(hydroxyglycolic) acid and its derivatives. ÅKE TYBERG. *Thesis Lund (Sweden)* 1924, 76 pp.—Forty-five salts of (CH₂SCH₂CO₂H)₂ and its Me or Et ester were made, using Cu, Ag, Pd and Pt. In the following list R = (CH₂-SCH₂CO₂)₂, Me₂R, Cu₂Cl₂ (I), m. 146°. Et₂R, Cu₂Cl₂ (II), m. 112°. Me₂R, Cu₂Br₂ (III), m. 176°. Et₂R, Cu₂Br₂ (IV), m. 135°. Me₂R, CuI (V), m. 127°. Et₂R, CuI (VI), m. 111°. H₂R, CuHR (VII), decomp. 200°. The Na salt (VIII) of VII has 10 mols. H₂O. Ag₂R (IX) decomp. 200°. H₂R, AgHR (X) decomp. 172°. The Na salt (XI) of X has 10 mols. H₂O. Cu₂R, H₂O (XII). H₂R, CuCl₂ (XIII). Me₂R, CuCl₂ (XIV), m. 138°. (Me₂R)₂, CuCl₂ (XV), m. 145°. H₂R, PdCl₂ 3H₂O (XVI), m. under 100°. Anhyd. XVI (XVII), decomp. 203°. Me₂R, PdCl₂ (XVIII), m. 185°. H₂R, PdBr₂ 3H₂O (XIX); H₂O-free (XX), partly m. 204°, decompd. 212°. Me₂R, PdBr₂ (XXI), m. 157°. H₂R, PdI₂ (XXII), m. 204°, indefinitely decomp. 206°. Me₂R, PdI₂ (XXIII), m. 154°. H₂R, Pd(CNS)₂ 2.5H₂O (XXIV); anhyd. XXIV (XXV), m. 176°. Me₂R, Pd(CNS)₂ (XXVI), m. 117°. HRPdNH₂Cl (XXVII), m. 177° indefinitely. (HR)₂Pd (XXVIII), darkens 175° and decomp. 179-81°. The Na salt (XXIX) of XXVIII has 6 mols. H₂O, vitrifies when exposed to the air and m. 125°. (H₂R)₂PdCl₂ 2H₂O (XXX), changes at 157° to a red wet mass and m. 173-5°. XXX with 0.5 mol. H₂O (XXXI), m. in part 173°, decomp. 178°. (H₂R)₂.PdNO₃ (XXXII), decomp. violently 130°. (H₂R)₂.PdSO₄ 2H₂O (XXXIII), m. 174° (decompn.).

(Me₂R). Pd(MeSO₄)₂. H₂O (XXXIV), m. 181°. PtR (XXXV). H₂R. PtCl₂ (XXXVI), m. 242°. K salt (XXXVII) of XXXVI, 1 mol. H₂O. Me₂R. PtCl₂ (XXXVIII), m. 188.5°. Et₂R. PtCl₂ (XXXIX), m. 153.5°. (HR)₂Pt. H₂O (XL), m. 214° (decompn.). The Na salt (XLI) of XL has 10 mols. H₂O. (H₂R)₂. PtCl₂. 0.5H₂O (XLII), m. indefinitely 167–71°. (H₂R)₂. Pt(NO₃)₂. H₂O (XLIII), decomp. violently 122–4°. (H₂R)₂. PtSO₄. H₂O (XLIV), m. 213.5°. (MeR)₂. Pt(MeSO₄)₂. H₂O (XLV), m. 187°. All the Pd and the last 4 Pt compds. in the above list have not been prep'd. before. Compds. VII, XXXVI, XXXVII, XL and XLI are described in *C. A.* 8, 1767. This reference also gives a clue to the related literature and abstracts the theoretical principles. The unusual affinity between Cl and PdR and PtR makes it difficult to get these pure; pure PdR was not obtained and PtR was of low yield. XXVII was obtained from (NH₄)₂-PdCl₂ and H₂R at room temp.; on warming the reaction gave (NH₄)₂R. PdCl₂, which in turn on prolonged heating gave PdR. XVI in hot water gives PdR. XVI is only slightly sol. in glacial AcOH. Whether XVI or XVII crystals out depends upon the strength from which it is recrystd., 1 or 4 N. XXXI is XXX recrystd. from 4 N HCl and XLII was recrystd. out of 4 N HCl. XIX was crystd. from 2 N HBr and XX from 66% HBr plus some glacial AcOH. XXV crystd. out of hot glacial AcOH giving bright red prisms. XXVI sep'd. from a mixture of acetone and MeOH. The soly. of XXVIII in water at 16° is 157 mg. per l. and 489 at 65°. XL is somewhat less sol. than XVIII. The Na (XXIX) and K salts are very sol. XLII is very sol. in H₃PO₄. XLII heated in H₂O with equal parts of KCNS gave H₂R. Pt(CNS)₂ which when recrystd. from glacial AcOH contained 1 mol. AcOH. XLIV was prep'd. from XL and 2.25 N H₂SO₄, insol. in MeOH and decompd. in H₂O. XLIII also decomp. in cold H₂O. The elec. cond. of XXXIV and XLV is independent of time interval between the dissolving and measurement. For XXXIV μ came to 355–8 at 25° and for XLV, 200–12. A. R. ROSE

Action of the Grignard reagent on amino acids. V. Acyl migration in amino alcohols and glycols. FRITZ BETZIECHE. *Z. physiol. Chem.* 146, 227–40 (1925), cf. *C. A.* 19, 636.—In the presence of concd. H₂SO₄ acyl migrates from N to O in amino alcs. With Me and Et derivs. the migration occurs readily, with PhCH₂ derivs. less readily, while with Ph derivs. it could not be demonstrated conclusively. The reversal of this reaction is very slow and in some cases could not be demonstrated at all. The final product may be an equil. mixt. of oxazoline and the BzOR base. The free NH₂ group after migration of Bz should, when treated with HNO₂, yield a glycol with Bz on the tertiary OH. What actually occurs, however, is a 2nd migration from the tertiary to the secondary OH. Although the BzOR bases were not isolated on account of the small amts. of material available, the sep'n. of an oil when the H₂SO₄ soln. was dild., extd. with Et₂O and made alk. with NaOH was considered evidence of migration in the case of BzNHCH₂C(OH)Me₂, BzNHCHPhC(OH)Me₂, BzNHCH₂C(OH)Et₂, BzNHCHMeC(OH)Et₂, BzNHCHPhC(OH)Et₂(I), less positive in the case of BzNHCH₂C(OH)(CH₂Ph)₂ and BzNHCHMeC(OH)(CH₂Ph)₂, and negative in the case of BzNHCH₂C(OH)Ph₂, BzNHCHMeC(OH)Ph₂ and BzNHCHPhC(OH)Ph₂. Boiling with 20% HCl gave similar results, except that with BzNHCHMeC(OH)(CH₂Ph)₂ the oxazoline-HCl resulting from loss of H₂O was identified. After the H₂SO₄ treatment of I HNO₂ gave an 82% yield of 1,1-diethyl-2-phenyl-1,2-ethanediol benzoate, m. 129°. Its remarkable stability toward oxidizing agents precludes the possibility of a free secondary OH group. A similar result was observed with BzNHCH₂C(OH)Et₂. Hence a migration of Bz from tertiary to secondary OH has occurred.

A. W. DOX

A method for the preparation of sarcosine ester. WALTER STAUDT. *Z. physiol. Chem.* 146, 286–9 (1925).—To 160 g. MeNH₂. H₂SO₄, 250 cc. 40% CH₃O soln. and 100 cc. H₂O, add a concd. soln. of 130 g. KCN from a dropping funnel while stirring with a turbine. Keep the temp. below 10° and pass in a rapid current of CO₂. Allow the mixt. to stand several hrs., ext. with Et₂O and dry over BaO. Distil off the Et₂O up to 50°, leaving a yellow oil (sarcosine nitrile). Treat 70 cc. of the crude oil with 900 cc. abs. EtOH and boil 3–4 hrs. with 500 cc. EtOH satd. in the cold with HCl. Filter off the NH₄Cl, evap. to 500 cc. and filter again. On chilling the oil, 30 g. of sarcosine ester-HCl sep's. in white scales. A 2nd crop is obtained by concg. the filtrate. After recrystn. from EtOH-Et₂O the product m. 131–2°. Further evap'n. in vacuo gives a mass of yellowish crystals which may be washed with Et₂O and dried over H₂SO₄ and KOH. The total yield is 103 g. or 62%. The liberation of free ester is performed by the Fischer method.

A. W. DOX

Chemistry of Jaffe's reaction for creatinine. III. 2,6-Dinitrophenol. ISIDOR GREENWALD. *J. Am. Chem. Soc.* 47, 2620 (1925); cf. *C. A.* 19, 1853.—2,6-(O₂N)₂-C₆H₃OH does not give a red color with creatinine and NaOH; this fact renders more

probable G.'s hypothesis that all 3 NO₂ groups of the picric acid undergo a change in the formation of the red tautomer of creatinine picrate.

C. J. WEST

Rearrangements of peptide-like substances. V. Conversion of serine into pyruvic acid and into alanine. MAX BERGMANN, ARTHUR MIEKELEY AND ERICH KANN. *Z. physiol. Chem.* **146**, 247-66(1925); cf. *C. A.* **19**, 1852.—The new type of anhydride of glycine and serine previously described and designated anhydro-glycylserine anhydride I is now shown to be 3-methylene-2,5-diketopiperazine (I). Alanine and serine form a similar deriv., 3-methylene-6-methyl-2,5-diketopiperazine (II). Oxidation of I in AcOH by O₃ gives 2,3,5-triketopiperazine (III), decomp. 240°. By hydrolysis of IV with *N* HCl the products obtained are (CO₂H)₂, glycine and NH₃. II was prepd. by esterification of *dl*-alanyl-*dl*-serine, treatment with SOCl₂ and then with NH₄OH. It darkens at 280° and carbonizes at 340°. Hydrolysis of II gives alanine, pyruvic acid, NH₃ and pyruvoylalanine (IV), m. 143.5°. The *Et* ester of IV, b₁₂ 140°, was prepd. by esterification with alc. HCl. Oxidation of II in AcOH with O₃ gave 6-methyl-2,3,5-triketopiperazine, m. 212-3°, and this on hydrolysis gave (CO₂H)₂, alanine and NH₃. By hydrogenation of I in AcOH with spongy Pd glycyl-*dl* alanine anhydride was obtained, and similar treatment of II gave alanine anhydride. II undergoes polymerization in the same manner as I when treated with *N* NaOH and then neutralized, the product being insol. in all org. solvents. By heating glycine anhydride 2 hrs. at 130° with (CH₃O)₃NaOAc and Ac₂O, 1,4-dimethylolacetate of 2,5-diketopiperazine, m. 111-2°, was obtained.

A. W. DOX

The optical activity of cystine. J. C. ANDREWS. *J. Biol. Chem.* **65**, 147-59 (1925).—"At low concns. of cystine (less than about 0.2 g. per 100 cc.) the value of $[\alpha]_D$ seems to depend chiefly upon the p_H of the soln., low p_H values giving low values for $[\alpha]_D$. At higher concns. of cystine, the effect of various ions is almost entirely specific and peculiar to the particular ions present. For any given acid, diln. with a const. concn. of that acid (at practically const. p_H) results in practically const. values for $[\alpha]_D$ Substitution of an equimol. concn. of the Na salt for the acid results in marked changes in the form of the diln. curves. The curves resulting from H₂O diln. show the form characteristic of dissociation reactions and probably represent, in the main, the dissociation of the cystine salt into its ions." The results with cystine picrate solns. show complete lack of dissociation on diln. The most const. and easily duplicable conditions are a 1% soln. of cystine in 1.00 *M* HCl, $[\alpha]_D^{25}$ -216°. The temp. coeff. is -1.7° for every 1°.

I. GREENWALD

The oxidation of cystine. J. C. ANDREWS. *J. Biol. Chem.* **65**, 161-4(1925).— $[\alpha]_D$ of alk. cystine solns. did not diminish any more rapidly when exposed to O₂ than when exposed to N₂. The absorption of O₂ by a Na₂S soln. was as rapid as that by an alk. soln. of cystine. Conclusion: cystine, in alk. soln., is not directly oxidized by O₂ and the observed absorption of O₂ is due to oxidation of S²⁻.

I. GREENWALD

The lead salts of some fruit acids. FR. AUERBACH AND H. WEBER. *Z. anorg. allgem. Chem.* **147**, 68-80(1925).—The fruit acids can be sepd. most readily by means of their Pb salts, but the literature upon soly., etc., of these salts is incomplete. The acids were pptd. with Pb(OAc)₂ in *N* soln., the acidity being controlled so that after pptn. it was 0.1 *N* AcOH. 30-100% excess of the acid and of the Pb(OAc)₂ were each used without affecting the compn. of the ppts. The solubilities of the benzoate, malate, succinate, citrate and tartrate (usually decreasing in that order) were found in H₂O, 0.01 and 0.1 *N* HCl, 1.0 and 4 *N* NaOAc and NH₄OAc and 50% EtOH. The solubilities were much higher in dil. acids, indicating probably complex compds. 50% EtOH was useful in sepg. tartaric and benzoic acids, Pb tartrate being insol. Convenient volumetric methods of analysis of the above Pb salts are given.

A. W. F.

Methylenecitric anhydride. The aniline derivative of citric and aconitic acids. C. A. NAY, E. B. BROWN AND J. R. BAILEY. *J. Am. Chem. Soc.* **47**, 2596-606(1925).—Methylenecitric anhydride (I), m. 153°, decomp. 190°, results in 66% yield from 100 g. of the acid and 112 g. PCl₅ or in 70% yield from 100 g. acid, 124 g. PhNMe₂ and 44 g. POCl₃ in 200 cc. CHCl₃. I is not distd. undecompd. *in vacuo*. It is not changed by heating with PCl₅ at 120°. With C₆H₅(OH)₂ it yields a fluorescein. I and PhNH₂ in AcOEt give methylenecitric acid monoanilide (II), m. 148° (decompn.); with excess of PhNH₂ there is formed the PhNH₂ salt, m. 90.5°, decomp. 115°; heated in soln. it splits off HCHO. II, dissolved in dil. HCl and allowed to stand 24 hrs., yields citranilic acid (III), m. 189°. Directions are also given for the prepn. of III from mono-PhNH₂ citrate. The PhNH₂ salt of III, m. 139°; when heated for 30 min. at 150°, this yields the anil-anilide of citric acid. III and PhNHNH₂ in H₂O give the PhNHNH₂ salt of the phenylhydrazide-anilide of citric acid, m. 132° (decompn.) which, with *N* HCl, gives

the free compd., m. 118°. Methylenechloride, MeOH and H₂SO₄ give the *di-Me ester*, m. 59.5°, also obtained from sym. di-*Me citrate* and HCHO. The reverse transformation occurs with *N* NaOH. I boiled with EtOH until soln. takes place gives *mono-Et methylenecitrate*, m. 109°. III and EtOH-NH₄OH give an *amide-anilide of citric acid*, m. 100-4° (decompn.). With KOH, NH₃ and PhNH₂ are split off. III, MeOH and H₂SO₄ give the *Me ester*, m. 89°; *Et ester*, m. 122°. The Et ester (2 g.) in 5 cc. abs. EtOH and 1-2 cc. 28% NH₄OH give the compd. CH₂CQ₂EtC(OH)(CONH₂)-CH₂CONHPh, m. 183° (decompn.). Adding an equal vol. concd. NH₄OH gives the compd. CH₂CONH₂C(OH)(CONH₂)CH₂CONHPh, m. 185°. Either of these compds. and concd. NH₄OH, boiled 0.5 hr., evapd. to dryness and treated with a little dil. HCl, gives the compd. CH₂CONH₂C(OH)(CO₂H)CH₂CONHPh, m. 171°. The Et ester with KOH gives the neutral *K salt*, softens at 70°, m. 121°; addn. of glacial AcOH to a concd. aq. soln. of the *K salt* gives the *acid K salt*, C₁₂H₁₃O₁₂N₂K, m. 153°. The calcd. amt. of HCl and the neutral *K salt* give *ethylcitranilide*, m. 108°, and at 150° loses 1 H₂O to give Et citranilate. *Aconityl anil*, m. 189°. *Me ester*, m. 149°; *Et ester*, m. 123°.

C. J. WEST

Mutarotation. V. Solution volumes and coefficient of refraction of fructose. C. N. RIBER AND V. ESP. *Ber.* 58B, 737-46 (1925); cf. *C. A.* 19, 1250.—R. and E. obtained the following values for the mol. soln. vol. and mol. refractivity at infinite diln.: Equil. fructose $V_{m\infty} = 110.026$ ml., $M_{\infty} = 62.03$, fructose, $V_{m\infty} = 108.445$, $M_{\infty} = 61.98$.

F. C. KRACEK

Lactone formation from mono- and dicarboxylic sugar acids. P. A. LEVENE AND H. S. SIMMS. *J. Biol. Chem.* 65, 31-47 (1925).—The lactones of gulonic, galactonic, glucoheptonic, 4-methylglucoheptonic, mannonic, 2,3,5,6-tetramethylmannonic and 2,3,4,6-tetramethylmannonic acids were dissolved in dil. NaOH and, after hydrolysis were neutralized or made acid with 1 equiv. of free HCl. The rate of lactone formation was followed with the polariscope. The nonsubstituted acids formed 2 lactones simultaneously, 1 with a 6-membered ring which reaches an equil. of 20-36% in a few hrs.; and another with a 5-membered ring which attains an equil. of 75-89% after several hundred hrs. The various acids form lactones at nearly the same speed. The methylated acids in which only 1 type of lactone formation is possible showed in each case an initial speed and a final equil. corresponding to the type of ring. In each case the rotation of the lactone was more dextro than the acid when the linkage involved a dextro-C atom and more levo when a levo atom was involved. The rates of lactone formation from saccharic, mannosaccharic, mucic and allomucic acids were observed by titration, were essentially identical and bore no relation to the soly. of the various lactones, nor to their ease of isolation. Within the range studied (200 hrs.) the reactions were essentially monomol., the curves showing no such sharp breaks as were found in those for the mono-CO₂H acids. The reactions were not carried on to completion nor was it possible to det. which of the 4 or 5 possible lactones were being formed. With mucic acid, the insoly. of 1 lactone and the fact the amt. of lactone formed and in equil. with the pptd. lactone was not a const. make it possible to calc. that at least 22% of the lactone was of a form different from that pptd. Under the same conditions, the formation of lactones from the di-CO₂H acids is somewhat slower than even the formation of the 5-membered ring with the mono-CO₂H acids but approaches about the same equil. The dissociation const. of *gulonic acid* was found to be 10^{-3.68} (cor. for activity).

I. GREENWALD

• **Liberation of carbon dioxide, ammonia and amino nitrogen from casein by acid hydrolysis.** M. S. DUNN. *J. Am. Chem. Soc.* 47, 2564-8 (1925).—The NH₂ N, CO₂ and NH₃ liberated from casein by H₂SO₄ hydrolysis during intervals from 5 to 30 hrs. are reported as tables and curves. NH₂ N from the acid hydrolysis of casein becomes const. after about 20 hrs. The total NH₃ liberated is in excess of the CO₂ at the beginning but after 5 hrs. these substances appear to be evolved at approx. the same rates. Structures are presented representing the possible sources of the CO₂ and of part of the NH₃ obtained by the acid hydrolysis of casein.

C. J. WEST

• **Photochemical oxidation of aromatic hydrocarbons.** I. J. J. SUDBOROUGH, H. E. WATSON AND B. T. NARAYANAN. *J. Indian Inst. Sci.* 8A, 1-7 (1925).—Eckert states (Indian pat. 8425) that 40% of BzOH can be obtained by atm. oxidation of PhMe exposed 6 weeks to sunlight in the presence of anthraquinone, which remains unaltered. As it was thought possible that the tropical sunshine of India would act more rapidly than the light of more temperate regions several expts. were made under conditions similar to those described by E. (except that H₂O equal to 0.5 the vol. of the hydrocarbon was added) and simultaneously a similar series was carried out with a Hg lamp. Quartz vessels were used throughout. The flasks (200 cc.) contg. 50 g. PhMe and 5 g. anthra-

quinone were filled with O and attached to an O reservoir and rocked at such a rate that the liquid was continuously splashed over the upper part of the interior surface of the flask which was exposed to the light. In the quartz lamp expts. the temp. of the liquid was 63–6°, in the sunlight expts. 29–50° (in a few cases a max. temp. of 53° was recorded). The addn. of PhNO₂ as catalyst produced practically no effect. With N instead of O, there was no reduction of the anthraquinone and no formation of BzOH. With *m*-xylene and mesitylene there was no marked oxidation after even 200 hrs. The amt. of acid formed, as detd. by titration, was always somewhat larger than that actually isolated as BzOH (probably on account of the presence of HCO₂H); it is roughly proportional to the length of exposure and is markedly influenced by the amt. of H₂O used. The yield of acid ranged in sunlight from 0.76% with 2.5 g. H₂O and 2.03% with 25 g. H₂O after 60 hrs. to 6.60 and 17.30%, resp., after 400 hrs., and in ultra-violet light from 4.7% with 2.5 g. H₂O and 15.7% with 25 g. H₂O after 200 hrs. to 16.3 and 34.8% after 600 hrs. C. A. R.

Analogies in the behavior of some derivatives of benzene and the corresponding derivatives of the aliphatic series. ANGELO ANGELI. *Mem. accad. naz. Lincei* [5], 14, 627–58 (1924); *Chem. Zentr.* 1925, 1, 221.—A summary and discussion of earlier work appearing in various articles which deal with the theoretical aspects of the chem. behavior of compds. of the A-B type on the one hand and of the corresponding *o*- and *p*-substituted derivs. of aromatic hydrocarbons of the A-R-B type on the other (cf. C. A. 18, 2883). C. C. DAVIS

Constitution of the aromatic substances and their physical and chemical properties.
II. The points of fusion of the R₂-benzenes. I. A. PASTAK. *J. chim. phys.* 22, 264–79 (1925); cf. C. A. 19, 1699.—The relation between structure and m. p. of the R₂-benzenes is disclosed by (I) the postulate that the influence of 2 equiv. radicals in the *m*-position may be replaced by that of one, taking the direction of their resultant, and (II) by the rule of the alternation of radicals. The radicals attached to the benzene nucleus are in two series: 1st, basic groups and 2nd, acid groups. The normal position of radicals of the same series would be *m*, while those of different series would be *o* and *p*, any other position being abnormal. It follows that (III) the normal (more stable) isomers have a lower m. p. and (IV-a) all the substituted benzenes may be classed as C₆H₄R₂ (of the same series, *m* normal) and C₆H₄R₂ (different series, *o* and *p* normal). The ideal curve of m. ps. for the 1st group must have its min. in *m*, while that of the 2nd group must have its max. in *m*. The *p*-isomer has always the highest m. p. showing that the influence of the *p*-tension is large enough and always positive. The real curves (I and II) of the m. ps. of the two groups are identical with those developed in the preceding article of this series (IV-b). The exceptions to the foregoing reverse the representative curves (V). The R₂-benzenes fall into 3 groups, having the double radical in the *o*-, *m*- and *p*-positions resp. and named as the α -, β - and γ -isomers. In analogy with α - and β -R-naphthalenes, the tensions of the α - and β -R₂-benzenes are in the relation $\tau_{\alpha} < \tau_{\beta}$ for a basic double radical; for $\tau_2 = (\text{NO}_2)_2$ the relation is reversed. By the law of the resultants, R₂-benzenes in *m* may be transformed into their corresponding bi-derivs. in *o*, *m*, *p*. The R₂-benzene with the double radical in the *p*-position has only one isomer (γ), which has its m. p. between that of α and β , i. e. $\tau_{\alpha} < \tau_{\gamma} < \tau_{\beta}$, or $\tau_{\alpha} > \tau_{\gamma} > \tau_{\beta}$ (VI). The tetrasubstituted benzenes C₆H₂R₄ present 6 isomers. The first 2 isomers have τ in the 1,2,3-positions and are named α and β and have $\tau_{\alpha} < \tau_{\beta}$. By the law of the resultants α may be transformed into a *m*-isomer and β into a *p*-isomer. The next 3 isomers have τ in the 2,4,5-positions and are named *o*, *m*, *p*, resp. (referring to the position of the two H atoms on the ring) and may be transformed, by the law of resultants, to the *o*-, *m*-, *p*-position with respect to R of the bi-derivs. The last isomer has τ in the 1,3,5-positions, is the single *p*-R₂-benzene and is named γ (VII). There are 3-penta substituted isomers of the form C₆HRR₄, presenting nothing new in structure or properties. In résumé, the isomers R₂ may be placed in 2 groups, (1) the alphabetic isomers (α , β , γ) and (2) the *ompa* isomers. For alphabetic isomerism, the multiplied radicals are found in abnormal position. For *ompa* isomerism, τ_2 are in the *m*-position for R₂-benzenes and in the 1,2,4-positions (transformed to the 1,3- or *m*-positions) for the R₂-benzenes. H. W. GIBSON.

Some physical properties of the nitro derivatives. LOUIS DESVERGNES. *Mon. sci.* 15, 149–58 (1925); cf. C. A. 19, 1700, 2036.—*m*-C₆H₄(NO₂)₂, recrystd. from EtOH, m. 90.60°; soly. in g./100 g. solvent: EtOH, 5.9 at 24.6°; H₂O, 0.0068, 0.0469 and 0.1910 at 13°, 15°, and 100°; org. solvents at 15° and 50°: EtOAc, 31.09, 148.44; Me₂CO, 72.365, 213.04; MeOH, 5.274, 11.08; EtOH (96%), 2.373, 11.49; EtOH (abs.) 2.553, 12.69; C₆H₆, 34.090, 195.89; CHCl₃, 30.507, 69.48; Et₂O, 6.743, 11.06 (at 30°); pyridine, 64.520, 216.25; CS₂, 1.225, 1.38 (at 33°); CCl₄, 0.966, 8.966; PhMe, 25.661, 134.80.

1,3,5-C₆H₃(NO₂)₃ (I), crystd. from HNO₃ and EtOH, m. 122.48°; soly.: H₂O, 0.0278, 0.102, and 0.498 at 15°, 50° and 100°; org. solvents at 17° and 50°; AcOEt, 29.826, 52.49; Me₂CO, 59.105, 160.67; EtOH (96%), 1.392, 3.52; EtOH (100%), 2.088, 4.57; MeOH, 3.759, 7.62; C₆H₆, 6.176, 25.70; CHCl₃, 6.242, 18.42; Et₂O, 1.703, 2.72 (at 32.5°); pyridine, 112.605, 194.23; CS₂, 0.239, 0.44 (at 33°); CCl₄, 0.237, 0.69; PhMe, 11.82, 76.31. The pyridine soln. of I was colored dark red; upon evapn. it left small brown crystals, which after treatment with CHCl₃ left an amorphous compd., did not m. above 210°. 2,4-Dinitrodiphenylamine, recrystd. from C₆H₆, m. 157.0°; soly.: H₂O, 0.0038, 0.0084, and 0.0143 at 15°, 50° and 100°; org. solvents at 15° and 50°; AcOEt, 2.319 and 6.105; Me₂CO, 3.765, 11.600; MeOH, 0.126, 0.611; EtOH (96%), 0.088, 0.460; EtOH (abs.), 1.30, 479; C₆H₆, 2.118, 6.977; CHCl₃, 5.826, 10.641; Et₂O, 0.378, 0.728 (at 30°); pyridine, 11.349, 28.665; CS₂, 0.245, 0.567 (at 32°); CCl₄, 0.168, 0.653; PhMe, 1.619, 6.352. 2,4,5,7-Tetranitrodiphenylamine, prepd. by nitration of 2,4-(O₂N)₂C₆H₃NHPh and crystn. from Me₂CO and CHCl₃, m. 199.0–9.5°; soly.: H₂O, 0.0082, 0.0103, and 0.0202 at 13.5°, 50° and 100°; org. solvents at 15° and 50°; AcOEt, 0.100, 0.519; Me₂CO, 3.400, 6.546; MeOH, 0.100, 0.519; EtOH (96%), 0.040, 0.233; EtOH (abs.), 0.063, 0.212; C₆H₆, 0.320, 0.998; CHCl₃, 0.201, 0.478; Et₂O, 0.024, 0.104 (at 35°); pyridine, 6.807, 12.472; CS₂, 0.015, 0.033 (at 37°); CCl₄, 0.020, 0.040; PhMe, 0.361, 0.710. Hexanitrodiphenylamine (II), recrystd. from HNO₃ and EtOH, m. 239–40°; soly.: H₂O, 0.006, 0.019 and 0.034 at 17°, 50° and 100°; org. solvents at 17° and 50°; AcOEt, 0.841, 1.251; Me₂CO, 0.573, 1.149; EtOH (96%), 0.073, 0.104; EtOH (abs.), 0.030, 0.117; MeOH, 0.092, 0.102; C₆H₆, nil, 0.399; CHCl₃, nil, 0.058; Et₂O, traces, 0.008 (at 34°); pyridine, 172.252, 485.26; CS₂, nil, 0.018 (at 35°); CCl₄, nil, 0.062; PhMe, 0.131, 0.293. Pyridine and II form a complex contg. 2 mols. II to 1 mol. C₆H₅N. *o*-p-MeC₆H₄NO₂, recrystd. from EtOH, m. 52.06°; soly.: H₂O, 0.0040, 0.0078, 0.0116 at 14.5°, 50° and 100°; org. solvents at 15; AcOEt, 91.13; Me₂CO, 168.51; MeOH, 13.70; EtOH (96%), 8.58; EtOH (abs.), 16.64; C₆H₆, 127.64; Et₂O, 80.83; CHCl₃, 105.02; pyridine, 90.27; CS₂, 72.57; CCl₄, 42.63; PhMe, 104.95. 2,4-Dinitrotoluene, recrystd. from HNO₃ and alc., m. 70.14°; soly.: H₂O, 0.027, 0.037 and 0.254 at 22°, 50° and 100°; org. solvents at 15°: AcOEt, 57.929; Me₂CO, 81.901; MeOH, 5.014; EtOH (96%), 1.916; EtOH (abs.), 3.039; C₆H₆, 60.644; CHCl₃, 65.076; Et₂O, 9.422; pyridine, 76.801; CS₂, 2.306; CCl₄, 2.431; PhMe, 45.470.

T. S. CARSWELL

Some new hydroxyurethans and chromoisomeric silver salts of their acyl derivatives. III. R. E. OESPER AND WALTER BROKER. *J. Am. Chem. Soc.* **47**, 2606–8 (1925); cf. C. A. 19, 969.—Hydroxamic acids, ROCONHOH, were prepd. from the following alcs.: PhOH, m. 102.5°; *o*-MeC₆H₄OH, m. 116°; *m*-deriv., m. 67.5°; *p*-deriv., m. 99°; *p*-ClC₆H₄OH, m. 127°; *o*-deriv., m. 119°; *m*-O₂NC₆H₄OH, m. 130.5°; their Bz esters, ROCON(H)OBz, m. resp., 105.5°, 76.5°, 102.5°, 92°, 100°, —, 99°. The *N*-Et deriv., PhOCONEtOBz, m. 45°; the derivs. of the next 3 compds. were oils. The *di*-Bz ester of *carbo*-*o*-methylphenoxhydroxamic acid, m. 54.5°; that of the *p*-deriv., m. 90°. The Ag salt of the Bz ester of carbophenoxhydroxamic acid was white when first pptd. and rapidly became light yellow; after washing with H₂O the color reverted to white. In boiling CHCl₃ it deposits yellow needles m. 150–5° (decompn.). PhNHOH and PhOCOCI give the *N*-Ph ester of carbophenoxhydroxamic acid, m. 124°, which with BzCl and NaOH gives the *N*-Ph ester of the Bz ester of the acid, PhN(CO₂Ph)OBz, m. 93°, identical with the compd. from the Ag salt and PhBr. The Ag salt of the Bz ester of *o*-MeC₆H₄CONHOH is yellow when first pptd. but turns white when washed with H₂O. Ligroin ppts. the white form from CHCl₃, EtOH the yellow. All the other Ag salts were observed in the white modification only. These results indicate that in both of the chromoisomeric salts the metal is "bound to N."

C. J. WEST

Defective influence of substituents in the benzene ring. IV. The partial bromination of derivatives of aniline. A. W. FRANCIS. *J. Am. Chem. Soc.* **47**, 2588–96 (1925); cf. C. A. 19, 2934.—The partial bromination curves (yield of highest brominated product plotted against the relative amt. of Br soln. added) are given for 42 derivs. of PhNH₂. With the exception of NO₂ compds. (and a few others, such as *m*-H₂NC₆H₄OH) the curve depends only upon the type of compd. (*o*, *m* or *p*) and not at all upon the nature of defective influence of the other substituents. This means that the effect of that group upon rate of substitution is identical for the 2 or 3 positions substituted, i. e., directive influence is distributed sym. around the ring.

C. J. WEST

Colors produced by the action of sulfuric acid upon some hydrazones. F. D. CHATTAWAY, S. J. IRELAND AND A. J. WALKER. *J. Chem. Soc.* **127**, 1851–5 (1925).—While the colors produced by dissolving hydrazones in concd. H₂SO₄ are not very characteristic, these given by many of the hydrazones of diphenylene-4,4'-dihydrazine (I), *p*-IC₆H₄NHNH₂ (II) and 4,2-I(Me)C₆H₃NHNH₂ (III) are of a peculiarly intense shade

of Co-blue. These colors are probably due to the formation of salts of a quinonoid structure. The colors produced by the NO_2 derivs. and alc. KOH are probably due to the production of salts of the *aci*-form of the NO_2 compd. The following gives the color and m. p. of the compd., the color with concd. H_2SO_4 and (in some cases) with alc. KOH. *Derivs. of I: Benzaldehyde*, pale yellow, 283° (decompn.), brilliant Co-blue, slowly fading to yellowish brown. *Salicylaldehyde*, pale yellow, 264° (decompn.), indigo-blue, changing to green and finally yellow. *Cinnamaldehyde*, yellow, 253° (decompn.), deep sap-green. *Anisaldehyde*, pale yellow, 248° (decompn.), bright green. *Acetophenone*, pale yellow, 250° (decompn.), heliotrope. *Benzophenone*, yellow, 145° (decompn.), bright violet, changing to a dirty black. *Pyruvic acid*, yellow, 225° (decompn.), dark orange-red changing to magenta, pale yellow in alc. KOH. *o-Nitrobenzaldehyde*, dark red, m. 247° (decompn.), intense brilliant Co-blue changing in 15–20 min. to a greenish or peacock-blue and after 1–2 hrs. to olive-green and then finally to yellowish brown, deep green in warm alc. KOH; *m-deriv.*, dark red, 257° (decompn.), color similar to the *o*-deriv. but changing less slowly, brown in alc. KOH; *p-deriv.*, deep red, 275° (decompn.) color similar to the *o*- and *m*-derivs.; alc. KOH gives a similar Co-blue color. The colors developed with the BzH and $\text{O}_2\text{NC}_6\text{H}_4\text{CHO}$ derivs. of II and III are also described.

C. J. WEST

Aromatic derivatives of germanium. G. T. MORGAN AND H. D. K. DREW. *J. Chem. Soc.* 127, 1760–8 (1925).—The PhMgBr (36 mols.) from 30.2 g. PhBr with 2.1 g. GeBr_4 in Et_2O give 40% tetraphenylgermane (I) and 0.5 g. triphenylgermanium bromide (II); 8 mols. PhMgBr and 4.4 g. GeBr_4 in CHCl_3 give 22% I, 26% II and, after steam distn. to remove Ph_2 , 0.4 g. triphenylgermanium oxide (III). I, creamy white in bulk, m. $230\text{--}1^\circ$ and volatilizes without decompn.; it is not attacked by boiling caustic alkalis; warming with concd. H_2SO_4 causes sulfonation with elimination of Ph groups; fuming HNO_3 causes nitration II, m. 138° ; it is hydrolyzed superficially to III by boiling H_2O or warm aq. caustic alkalis. While II is a by-product in the above preps. it becomes the chief product when 5 mols. PhMgBr react with 1 mol. GeBr_4 . III, m. $182\text{--}3^\circ$, is quant. formed by boiling II with AgNO_3 ; it is unattacked by 50% aq. KOH but is quant. converted to II by HBr (d. 1.45). II and Na in $\text{C}_6\text{H}_5\text{Me}$ give hexaphenyl-digermene, cryst. with 3 mols. C_6H_6 , m. 340° , mol. wt. in boiling C_6H_6 , 566, 560, thus showing no recognizable tendency to dissociation. The aq. mother liquors from the hydrolysis of the Grignard mixt. deposit an amorphous phenylgermanous acid (germanibenzoic acid), $\text{C}_6\text{H}_5\text{O}_2\text{Ge}$. GeBr_4 and 5 mols. PhMgBr give 37.5% II and a residual oil, consisting of a mixt. of lower phenylated derivs.; when this is warmed with AgNO_3 in dil. EtOH and repeatedly crystd. there are sepd. some III, tetra-anhydrotetrakisdi-phenylgermanediol (IV) and trianhydrotetrakisdi-phenylgermanediol (V). IV, $\text{O}(\text{GePh}_2)_4$, m. indefinitely 218° , mol. wt. in boiling

C_6H_6 , 905, monoclinic crystals, $a:b:c = 1.491:1:1.108$, $\beta 111^\circ 4'$, $d(110)$, $d(101)$, $d(001)$, $s(201)$; optically the crystals are positive, the axial plane is $b(010)$ and 1 optic axis is nearly normal to $a(100)$. V, $(\text{HIOGePh}_2\text{OGePh}_2)_2\text{O}$, m. 149° , orthorhombic, $a:b:c = 0.9539:1.05399$, $a(100)$, $m(110)$, $n(120)$, $b(010)$, $o(111)$; optically the positive acute bisectrix is parallel to the c -axis and the axial plane is a . There is also formed a complex diol, $\text{C}_{16}\text{H}_{16}\text{O}_6\text{Ge}_2$, m. $277\text{--}8^\circ$, mol. wt. in boiling C_6H_6 , 1003, which crysts. with EtOAc (about 2 mols. diol and 1 EtOAc), m. 231° . Notes on the analysis of these derivs. are given.

C. J. WEST

Syntheses of disulfoxides. D. T. GIBSON, C. J. MILLER AND SAMUEL SMILES. *J. Chem. Soc.* 127, 1821–4 (1925).—The fact that disulfoxides apparently cannot be obtained from RSO_2Cl and R'SH has been utilized as evidence against the thiolsulfonate structure of these substances. It is possible to carry out this synthesis by adding the R'SH in C_6H_6 contg. a small quantity of $\text{C}_6\text{H}_5\text{N}$ to a boiling soln. of excess of the RSO_2Cl in the same solvent; $p\text{-MeC}_6\text{H}_4\text{SO}_2\text{Cl}$ was obtained in 25% yields from 2 mols. $p\text{-MeC}_6\text{H}_4\text{SH}$ and 5 mols. $p\text{-MeC}_6\text{H}_4\text{SO}_2\text{Cl}$; $(2,5\text{-Cl}_2\text{C}_6\text{H}_3\text{SO}_2)_2\text{O}$ in 5% yields from 1 mol. $2,5\text{-Cl}_2\text{C}_6\text{H}_3\text{SH}$ and 7 mols. $2,5\text{-Cl}_2\text{C}_6\text{H}_3\text{SO}_2\text{Cl}$. 4-Tolyl 3-nitrobenzenethiolsulfonate, m. 109° , in 30% yield from 8 mols. $3\text{-O}_2\text{NC}_6\text{H}_4\text{SO}_2\text{Cl}$ and 1 mol. $p\text{-MeC}_6\text{H}_4\text{SH}$. The same object is more easily obtained by the use of the more reactive iodides. 2,5-Dichlorobenzenesulfonyl iodide (I), Au-yellow, m. 100° (80% yield); naphthalene-2-sulfonyl iodide (II), yellow, m. $96\text{--}7^\circ$ (decompn.). I and 2,5- $\text{Br}_2\text{C}_6\text{H}_3\text{SH}$ give 88% of $\text{Br}_2\text{C}_6\text{H}_3\text{SSO}_2\text{C}_6\text{H}_3\text{Cl}_2$, m. 124° . I and $p\text{-MeC}_6\text{H}_4\text{SAG}$ give 80% of 4-tolyl 2,5-dichlorobenzenethiolsulfonate, m. 74° . II and 4,3- $\text{MeO}(\text{HS})\text{C}_6\text{H}_3\text{Me}$ give about 85% of 6-methoxy-3-tolyl 2-naphthalenethiolsulfonate, m. $113\text{--}4^\circ$. 2,4-Xylol 2-naphthalenethiolsulfonate, m. $80\text{--}1^\circ$. These results give further evidence in favor of the thiolsulfonate structure of these compds.

C. J. WEST

Arylselenoglycolic acids. G. T. MORRIS AND WM. H. PORRITT. *J. Chem. Soc.* 127, 1755-9 (1925).—Arylselenoglycolic acids are prepd. by decomp. the $\text{aryl}.\text{SeMgBr}$ with ice and HCl , extg. the aryl SeH with alkali and reacting it with $\text{ClCH}_2\text{CO}_2\text{Na}$; the yields are 20-25%, 15-20% of $(\text{aryl}.\text{Se})_2$ being formed by oxidation during the extn. with alkali. In general these resemble the S analogs, but they do not exhibit any marked tendency towards ring formation under the influence of ClSO_3H at -5° to 40° . They are oxidized by 25% H_2O_2 to arylselenoxyglycolic acids, but excess of H_2O_2 produces no further oxidation. They are very resistant to HNO_3 . They develop characteristic colors with concd. H_2SO_4 . *Phenylselenoglycolic acid*, b_{760} 160° , m. 40° ; K salt, plates with silvery luster; concd. H_2SO_4 gives a deep purple color; the bright green Cu salt is insol. in H_2O . *p-Br deriv.* (I), m. 127° (from $p\text{-C}_6\text{H}_4\text{Br}_2$), the Ag salt is only slowly decompd. by light; the green Cu salt is insol.; concd. H_2SO_4 gives a deep brown color. H_2O_2 gives the *oxy deriv.*, $p\text{-BrC}_6\text{H}_4\text{SeOCH}_2\text{CO}_2\text{H}$, m. 187° ; the alkali and NH_4 salts are colorless and sol.; the pale blue Cu salt is insol. With 1 mol. Br in CHCl_3 , I gives a *dibromide*, Au-yellow, decompg. $120\text{--}30^\circ$; with 2 mols. Br there results the *tetrabromide*, scarlet needles, decompg. on warming. *p-Tolylselenoglycolic acid* (II), m. 98° ; concd. H_2SO_4 gives a carmine-red color; the green Cu salt is insol. The *oxy deriv.* (III) m. 165° and liberates I from aq. KI. With 1 mol. Br II gives a Au-yellow *dibromide*, decompg. $90\text{--}100^\circ$; aq. KI regenerates II with a proportion of III and liberation of I; in moist air it is easily hydrolyzed, giving brownish red oils of complex constitution. *Tetrabromide*, scarlet needles, decompg. on warming, is readily hydrolyzed. *α -Naphthylselenoglycolic acid*, m. 51° , and gives a green color with concd. H_2SO_4 .

C. J. WEST

The production of chloranil from aromatic compounds and its application to organic analysis especially of arsenical compounds. MICHELS AND HINCHOT. *Bull. acad. roy. méd. Belg.* [5], 5, 213-28 (1925).—While former investigators have used aqua regia for obtaining chloranil from C_6H_6 derivs., M. and H. prefer a mixt. of KClO_3 and HCl for this purpose. The amt. of chloranil obtained from various aromatic compds., with 0.2 g. of each, is listed. The output is naturally the highest for *p*-compds., such as *p*-aminophenol and its derivs., or hydroquinol; Ph_2NH also yields very much (0.480 g. from 0.2). Atosyl and its Ac deriv., arsacetin, both yield about 60% of chloranil. Arspenamipine, neorsphenamine and stovarsol, however, yield only a yellow resinous substance, but no chloranil. The reaction can be used, therefore, analytically to discriminate between those As compds.

R. BEUTNER

Nature of the alternating effect in carbon chains. III. Comparative study of the directive efficiencies of oxygen and nitrogen atoms in aromatic substances. E. L. HOLMES AND C. K. INGOLD. *J. Chem. Soc.* 127, 1800-21 (1925); cf. *C. A.* 19, 2035.—Previous work has indicated that directive action depends upon the unsat. rather than the polar character of the atom producing it. Recently Robinson has advanced the suggestion that atoms, previously regarded as negative, such as the O atom of ethers, may, on occasion, act as positive key-atoms by functioning as "onium" elements. The present work was undertaken with this suggestion in view. The theoretical discussion brings out the following points: According to the affinity theory derivs. of PhCH_2NH_2 (I) should show a greater tendency towards *m*-substitution and a smaller tendency towards *o,p*-substitution than the PhCH_2OH (II), and *m*-directive action should never prevail amongst the latter. Polarity principles require that I shall show a greater tendency to *o,p*-substitution and a smaller tendency to *m*-substitution than II. Examples quoted from other work and presented in this paper afford strong grounds for the conclusions that *o,p*-substitution prevails among II derivs. of the type PhCH_2NOA , whether A = alkyl or acyl; that oxonium salt formation with the reagent employed is not the cause of the phenomenon; that not only is *m*-substitution a frequent experience with I derivs., but that it prevails in every case in which substitution through a salt is precluded. *s-Tribromophenyl p-nitrobenzyl ether*, m. 145° , results by the nitration of $\text{Br}_3\text{C}_6\text{H}_3\text{OCH}_2\text{Ph}$ or from $p\text{-O}_2\text{NC}_6\text{H}_4\text{CH}_2\text{Cl}$ and $\text{Br}_3\text{C}_6\text{H}_3\text{ONa}$. Similarly *o,p*-(O_2N) $_2$ - $\text{C}_6\text{H}_3\text{OCH}_2\text{Ph}$ gave *o,p*-(O_2N) $_2$ - $\text{C}_6\text{H}_3\text{OCH}_2\text{C}_6\text{H}_4\text{NO}_2$ -*p*. $\text{PhCH}_2\text{ONO}_2$ and HNO_3 at -10° give *p*- $\text{O}_2\text{NC}_6\text{H}_4\text{ONO}_2$, m. 71° . *Phthalobenzylamic acid*, $\text{PhCH}_2\text{NHCOC}_6\text{H}_4\text{-O}_2\text{H}$, m. 155° , is an intermediate product in the prepn. of I. Nitration of I at -10° gave the *m*-nitro deriv. (III), as the principal product with some of the *p*-deriv. (IV); at 100° only III is formed (quant. yield). III, oily, gives a *HCl* salt, m. 250° and a *HNO}_3* salt, m. 214° (decompn.). IV, oily, yields a *HCl* salt, m. 224° and a *HNO}_3* salt, yellow, m. $180\text{--}1^\circ$. The *o*-deriv. is also oily; its *HCl* salt m. 248° ; *HNO}_3* salt, m. $173\text{--}4^\circ$ (decompn.). *p-Toluenesulfonbenzylamide*, m. 114° ; MeI gives the *methylamide*, m. 95° , which is hydrolyzed by concd. HCl at $165\text{--}70^\circ$ to PhCH_2NHMe (V), whose *HCl* salt, m. 195° . V was also obtained from PhCH_2Cl , EtOH and 33% MeNH_2 . Nitration

of V at low temps. gave about 80% of VI and 10% of VII; at 100° only VI could be isolated. *m*-Nitro deriv. (VI) of V, oily, whose *HCl* salt, m. 182° and *HNO*₃ salt m. 150°; *p*-deriv. (VII), oily, whose *HCl* salt, m. 226°. Nitration of (PhCH₂)₂NH at -5° to 0° gave about 5% of VIII and 80% of IX, while at 70–90° only IX was obtained (nearly theoretical yield). *p,p'*-Dinitrodibenzylamine (VIII), pale buff, m. 93°; *HCl* salt, m. 217–8°; *HNO*₃ salt, pale yellow, m. 210–1°. *m,m'*-Deriv. (IX), lemon-yellow, m. 83.5°; *HCl* salt, pale yellow, m. 253°; *HNO*₃ salt, pale yellow, m. 235° (decompn.). The *o,o'*-deriv. gives a nitrate, pale yellow, m. 200–3° (decompn.). Methylidibenzylamine-*HCl*, m. 200–1°; nitration with cold or warm *HNO*₃ gave only the *p,p'*-dinitro deriv., whose *HCl* salt, pale yellow, m. 204–5°; *HNO*₃ salt, m. 146°. The *o,o'*-deriv. yields a *HCl* salt, m. 216° and a *HNO*₃ salt, pale yellow, m. 125° (decompn.). The *m,m'*-deriv. m. 83–4° and yields a *HCl* salt, pale buff, m. 223–4°, and a *HNO*₃ salt, pale yellow, m. 163° (decompn.). If in the methylation of PhCH₂NHAc, *o*- or *m*-NO₂ compds. are formed along with the *p*-deriv., the amt. is very small. The same is true of PhCH₂NMeAc. Aceto-*m*-nitrobenzylmethylamide, m. 56–7°; the *p*-deriv. m. 80–1°. Acetodibenzylamide, viscous oil, b₃ 194–5°; nitration at -5° with 95% *HNO*₃ gave 45% *p*-, 20% *m*- and 3% *o*-dinitro derivs. At 30–50° with 80% *HNO*₃ the proportions were 30, 40 and a trace. Boiling with 70% *HNO*₃ for 15 min. gave 20% *p*- and 55% *m*-deriv. Aceto-*o,o'*-dinitrodibenzylamide, pale yellow, m. 154°; *m,m'*-deriv., pale yellow, m. 146°; *p,p'*-deriv., m. 183–4°. Diacetylbenzylamine, b₃₀ 176–8°. Nitration with 95% *HNO*₃ at -20° gave only *m*-O₂NC₆H₄CH₂NH₂·HCl after hydrolysis. C. J. W.

New synthesis of aldehydes. HENRY STEPHEN. *J. Chem. Soc.* 127, 1874–7 (1925).—Finely powd. anhyd. SnCl₄ (1.5 mols.) is suspended in dry Et₂O, which is then satd. with dry HCl until the mixt. seps. into 2 layers, the lower viscous layer consisting of SnCl₄ in Et₂O·HCl; 1 mol. nitrile is added with vigorous shaking and after a few min. the salt (RCH.NH.HCl)₂·SnCl₄ seps., which is readily hydrolyzed by warm H₂O. The method is applicable to aliphatic and aromatic nitriles and the yields are usually quant. If the nitrile is only sparingly sol. in Et₂O, CHCl₃ may be used. *o*-MeC₆H₄CN and α -C₁₀H₇CN gave only small yields of aldehyde, probably because of steric hindrance. The following aldehydes were prepd.: C₁₁H₁₅CHO, b₁₁ 65°; *p*-nitrophenylhydrazone, bright yellow, m. 80°; C₁₃H₁₇CHO, b₁₀ 155°; *p*-nitrophenylhydrazone, bright yellow, m. 95°; C₁₅H₂₁CHO, m. 34°; *p*-nitrophenylhydrazone, yellow, m. 96.5°; C₁₇H₂₅CHO, m. 38° (Krafft, *Ber.* 13, 1417 (1880) gives 63.5°); *p*-nitrophenylhydrazone, yellow, m. 101°; BzH; 3,4,5-(MeO)₃C₆H₂CHO, m. 74–5°; indole, from *o*-O₂NC₆H₄CH₂CN; *o*-MeC₆H₄CHO, b₁₀ 94°; *p*-nitrophenylhydrazone, red, m. 222°; *p*-MeC₆H₄CHO, b₁₀ 106°; *p*-nitrophenylhydrazone, red, m. 200.5°; *o*- and *p*-ClC₆H₄CHO; PhCH₂CHO; *p*-ClC₆H₄CH₂CHO; *p*-MeC₆H₄CH₂CHO, whose *p*-nitrophenylhydrazone, yellow, m. 144.5°; PhCH:CHCHO; PhCH₂CH₂CHO; α -C₁₀H₇CHO, m. 33–4°; *p*-nitrophenylhydrazone, orange, m. 234°. C. J. WEST

Beckmann's rearrangement. XIII. Catalytic action of reduced copper on benzaldioximes. SHOZO YAMAGUCHI. *Mem. Coll. Sci. Kyoto Imp. Univ.* 9A, 33–6 (1925); cf. C. A. 18, 2880.—Although the conversion of PhCH:NOH into BzNH₂ by heat or concd. H₂SO₄ and of PhCH:CHCH:NOH into isoquinoline has been observed, it is generally considered that only ketoximes and not aldioximes undergo the Beckmann rearrangement. Y. has now tried with α - and β -PhCH:NOH the method which has been successfully employed for the B. rearrangement of ketoximes, viz., treatment with H and reduced Cu at 200°; from 15 g. of the α -compd. he obtained 2.0 g. BzNH₂, 0.8 g. BzOH, 0.9 g. PhCN and 0.35 g. NH₃, while 10.5 g. of the β -compd. gave 1.0 g. BzNH₂, 0.75 g. BzOH and 0.62 g. PhCN. The formation of BzOH and PhCN in the same mol. ratio from both the α - and β -compds. not only confirms the view of Komatsu and Kurata (C. A. 18, 2156) that the BzOH and PhCN are derived from BzNH₂, formed by intermol. rearrangement, but also makes it probable that the β -oxime is to a large extent first transformed into the α -compd. C. A. R.

New synthesis of arylazoaldoximes. T. K. WALKER. *J. Chem. Soc.* 127, 1860–3 (1925).—Since the interaction of aryl diazonium salts and CH₂(CO₂H)₂ does not always produce formazyl compds., it was supposed that this might be due to the presence of HNO₂; it is now found that the simultaneous action of an aryl diazonium salt and HNO₂ on monoalkylated CH₂(CO₂H)₂ gives a nearly quant. yield of formazyl deriv. A mixt. of PhN₂Cl and PhCH₂CH(CO₂H)₂, treated after 5 min. with 1.5 mols. 2% aq. HNO₂, gives quant. benzeneazobenzylformaldoxime, deep yellow, m. 144°, also obtained by the action of HNO₂ on phenylpyruvic acid phenylhydrazone; phenylcarbamate, scarlet, m. 154°; Bz deriv., ruby, m. 144–5° (decompn.). *p*-Tolueneazobenzylformaldoxime, yellow, m. 93° (25% yield). Et phenylpyruvate *p*-tolylhydrazone, orange, m. 72°; hydrolysis gives phenylpyruvic acid *p*-tolylhydrazone, yellow, m. 158° (decompn.), which

with HNO_2 gives *p*-tolueneazobenzylformaldoxime, orange-red, m. 144° (slight decompn.), monoclinic holohedral, $a:b:c = 1.352:1:1.216$, $\beta 83^\circ 17'$; forms present (100), (101), (10 $\bar{1}$) and (110). Phenylcarbamate, orange-red, m. $152-3^\circ$ (decompn.). Benzeneazobenzaldoxime was obtained in 25% yields.

C. J. WEST

Walden inversion. IX. Influence of the solvent on the sign of the product in the conversion of β -bromo- β -phenylpropionic acids into β -hydroxy- β -phenylpropionamides. GEORGE SENTER AND A. M. WARD. *J. Chem. Soc.* 127, 1847-51 (1925); cf. C. A. 19, 483.—The reaction of NH_3 in EtOH, MeCN or of liquid NH_3 upon *dl*- $\text{BrCHPhCH}_2\text{CO}_2\text{H}$ (I) gives $\text{HOCHPhCH}_2\text{CONH}_2$ (II) and PhCH:CH_2 but no β - NH_2 acid. NH_3 and I in dry Et_2O give the *Nil*₄ salt, which decomp. fairly rapidly in the dry state at room temp. and rapidly at 60° (without melting), giving NH_4Br , CO_2 , PhCH:CH_2 and some $\text{PhCH:CHCO}_2\text{H}$. The *EtNH* salt is even more unstable, the temp. of rapid decompn. in the dry state being $44-5^\circ$. When an optically active I is used, the resulting II is opposite in sign to the acid used. The following gives the solvent, the $[\alpha]$ of the Br acid and of the amide: liquid NH_3 , 74.6° — 27.5° ; EtOH, — 75.1° , 24.3° ; MeCN, 81.7° , — 28.2° ; H_2O , — 85.0° , 27.8° . Very little racemization accompanies the reaction. Since the resulting amide possesses the same sign as the initial HO acid, a Walden inversion has not occurred; the only examples yet obtained of either isomer being produced in preponderating amts. by solvent variation alone is in the single instance in which Ph and CO_2H are both attached to the asym. C atom.

C. J. WEST

Glycol esters of certain aromatic acids. L. H. CRETCHER AND W. H. PITTENGER. *J. Am. Chem. Soc.* 47, 2560-3 (1925).—Glycol esters of aromatic acids were prepd. in order to study their physiol. properties. Glycol monobenzoate (I), $b_{12} 173^\circ$, $d_{15}^{15} 1.0837$, in 85% yield from $\text{HOCH}_2\text{CH}_2\text{Cl}$, BzONa and about 1% Et_3NH . Salicylate, $b_{12} 172^\circ$, $d_{15}^{15} 1.2537$ (75% yield). Phenylcinchoninate, m. 90° (70% yield). *p*-Nitroaminobenzoate, m. 77° (83% yield). Reduction with Fe and HCl gives the *p*-aminobenzoate (II), m. 132° (80% yield). I gives a phenylurethan, m. 115° . I, distd. at atm. pressure, forms the dibenzoate and $(\text{CH}_2\text{OH})_2$ practically quant. There were thus formed the disalicylate, m. 78.5° , and the *di-p*-nitrobenzoate, m. 140° . The min. lethal dose of II for rats is 450 mg. per kg. body wt. (injected into the saphenous vein) as compared to 40 mg. for novocaine. II possesses, qual., the same toxic properties as novocaine. The free base (up to a 25% mixt. with talc) or the HCl (up to 5% soln.) has no anesthetic properties towards the eye of a rabbit when applied continuously for 45 min. Injected subcutaneously, the HCl salt is approx. equal to novocaine in anesthetic effects but produces anesthesia less rapidly. A 3% soln. of the HCl salt produces edema, bloody transudate and induration and is therefore not suitable for use as a local anesthetic.

C. J. WEST

Preparation of phthalamic acids and their conversion into anthranilic acids. ERNEST CHAPMAN AND HENRY STEPHENS. *J. Chem. Soc.* 127, 1791-7 (1925).— $\text{C}_6\text{H}_4(\text{CO})_2\text{O}$ stirred with warm NH_4OH (d. 0.88) gives 94% of NH_4 phthalamate, from which 81% of the free acid is obtained on acidifying with concd. HCl. This readily yields *o*- $\text{H}_2\text{NC}_6\text{H}_4\text{CO}_2\text{H}$ with NaOCl . *Nil*₄ 4,5-dibromophthalamate, partly m. 227° with loss of H_2O and NH_3 , solidifies and then m. $238-42^\circ$ (91% yield); the free acid (93% yield), softens $215-6^\circ$ with loss of H_2O and formation of the imide, m. $242-3^\circ$. NaOCl gives 94% of 4,5-dibromoanthranilic acid, m. 224° (decompn.); *Ac* deriv., buff-colored, m. 240° . $3\text{-O}_2\text{NC}_6\text{H}_3(\text{CO})_2\text{O}$ yields exclusively 2-nitrophthalamic acid, which gives 90% of 3,2- $\text{O}_2\text{N}(\text{H}_2\text{N})\text{C}_6\text{H}_3\text{CO}_2\text{H}$, m. $208-9^\circ$; *Ac* deriv., bright yellow, m. $180-1^\circ$. $4\text{-O}_2\text{NC}_6\text{H}_3(\text{CO})_2\text{O}$ gives an inseparable mixt. of 4- and 5-nitrophthalamic acids (proportion, 2:3); the orientation and relative amts. were detd. by conversion into the anthranilic acids.

C. J. WEST

Phenylbenzylglyoxal. CHARLES DUFRASSE AND HENRI MOUREU. *Compt. rend.* 180, 1946-9 (1925); cf. C. A. 18, 1281.— $\text{PhCOCOCH}_2\text{Ph}$ is dimorphous; dependent on the conditions of prepn., the unstable form m. 67° and the stable form (I), with which this article is concerned, m. 90° . In the air it rapidly oxidizes, yielding BzOH and other substances, not yet detd., m. 194° and 236° , resp. A peculiarity of I is its ability to form varied metallic derivs., some of them well crystd. and many brilliant in color. Among these are a ferric deriv. (intense greenish brown, attacked by Na, with formation of an unstable red-purple deriv.), salts of Cu (greenish yellow), of Zn (golden yellow) and of U (blood-red). SbCl_3 , in the presence of alc., yields a cryst. ppt. in massive golden yellow prisms m. $179-80^\circ$, stable when dry and decompd. by H_2S . With NH_2OH in the cold, I yields small quantities of the

dioxime and the monoxime and also a large amt. of an isomer of the monoxime, the constitution of which has not yet been detd. Crystd. I is converted by the action of heat, preferably by slow distn. into its liquid isomer (II), golden yellow, b_D^{20} 191–2°, b_D^{25} 157–8°, oxidizable in the air and gives the same metallic derivs. and *N*-products as I. Its metallic derivs. decompd. by an appropriate acid, yield I only. The reactions of I lead to the conclusion that it is 1 of 2 stereoisomers of the enolic form, $\text{PhCOG}(\text{OH})\text{:CHPh}$. II, by reason of its very analogous behavior, may be also of the enolic form. However, titration with Grignard's reagent discloses a deficiency in enolization and forces the conclusion that at least part of II is of the ketonic form. The most probable hypothesis is that II is a mixt. with the diketonic element predominating.

H. W. GIBSON

Derivatives of δ - δ -o-aminobenzoylvaleric acid. MARGARET JOYCE PATERSON AND S. C. P. PLANT. *J. Chem. Soc.* 127, 1797–9 (1925); cf. *C. A.* 17, 1962.—The constitution of $\text{H}_2\text{NC}_6\text{H}_4\text{CO}(\text{CH}_2)_4\text{CO}_2\text{H}$ (I) is proven by its conversion, through the diazo compd., into $\text{HOC}_6\text{H}_4\text{CO}(\text{CH}_2)_4\text{CO}_2\text{H}$, m. 94° (von Braun, *C. A.* 17, 1958). I does not yield a phenylhydrazone, oxime or semicarbazone. *Ac deriv* of I m. 153°; heating with KOH gives γ -4-hydroxy-2-methylquinoline-3-butyric acid, m. 241°. *Formyl deriv.* of I m. 160°.

C. J. WEST

α -Chlorostyrene. CHARLES DUFRAISSE AND J. E. VIEL. *Bull. soc. chim.* 37, 874–9 (1925).—The action of PCl_5 on PhCOMe (I) does not lead easily to pure PhCClCH_2 (II) because of the formation of $\text{PhCHClCH}_2\text{Cl}$ by the action of HCl on II. Therefore D. and V. used an elevated temp. to diminish the soly. of HCl and a solvent, which was kept boiling, to remove the HCl. The solvent also prevented too great resinification. From PCl_5 , I, and petr. ether, b. 50–80°, were obtained 54% II, b. 64°, unattacked I, and HCl. The II was almost perfectly pure, being free of isomers and of products of oxidation by the air; it m. –24° to –23° and had d. 1.1224, 1.1131, 1.1029 at 0°, 10.5° and 20.5° d_4^{20} 1.5584, MR found 40.51. II is easily oxidized by the air to HCHO and BzCl , with subsequent resinification and is somewhat unstable even in a vacuum, for a sample kept thus for 4 years b_D^{20} 67.5–75° with 11% as residue; the fraction b_D^{20} 67.5–8° was 30% of the whole. II is slightly changed by distn. at atm. pressure; it is not easily attacked by alc. KOH, only 38% of the halogen being removed by treatment with 24% alc. KOH for 1 hr. at 80° and 78% by treatment for 3 hrs. at 120° in sealed tubes.

MARGARET W. McHERSON

Parachor and chemical constitution. II. Geometrical isomerides. SAMUEL SUGDEN AND HENRY WHITTAKER. *J. Chem. Soc.* 127, 1868–74 (1925); cf. *C. A.* 19, 2926. The surface tension and the d. of 5 pairs of geometrical isomerides have been measured over a range of temp. All the substances examd. contain a non-polar double bond adding 23.2 units to the mol. parachor. The *cis*-compds., in which 2 bulky groups are adjacent, have slightly higher parachors than the corresponding *trans*-compds. The following data are reported. Me cinnamate, m. 33.5° (all rr. ps. are cor.), d_4^{25} 1.107–0.000795t, γ 37.17, 35.78, 35.05, 33.80 and 32.60 at 46, 56, 67, 75 and 90°, parachor (P) 373.9. Me *trans*-cinnamate, b_D^{20} 129–30°, d_4^{25} 1.107–0.000977t, γ 40.17, 37.53, 34.93 and 32.88 at 20, 41, 62 and 78°, P 376.1. Me α -bromocinnamate, b_D^{20} 165°, d_4^{25} 1.500–0.001238t, γ 45.59, 44.32, 41.80, 40.47, 38.22, 33.87 and 31.57 at 20, 30, 51, 61, 81, 112 and 131°, P 426.6. Me α -bromoallicinnamate, b_D^{20} 153.5–4°, d_4^{25} 1.475–0.001195t, γ 43.41, 42.30, 40.20, 38.77 and 36.10 at 20, 30, 48, 60 and 81°, P 427.9. Me β -bromocinnamate, b_D^{20} 166.5°, d_4^{25} 1.490–0.00113t, γ 44.79, 42.36, 40.21, 39.96 and 37.49 at 20, 32, 53, 61 and 77°, P 424.8. Me β -bromoallicinnamate, m. 59°, d_4^{25} 1.461–0.00121t, γ 36.04, 35.23, 34.07, 33.54 and 32.70 at 66, 71, 81, 86 and 94°, P 427.5. Di-Me mesaconate, b_D^{20} 100°, d_4^{25} 1.148–0.00110t, γ 34.68, 33.80, 30.80, 29.84 and 27.68 at 20, 32, 52, 63 and 80°, P 341.9. Di-Me citraconate, b_D^{20} 103.5°, d_4^{25} 1.140–0.00108t, γ 35.69, 34.51, 31.37, 30.78 and 28.20 at 20, 32, 53, 64 and 79°, P 346.1. Di-Me fumarate, m. 102°, d_4^{25} 1.170–0.00114t, γ 25.67, 23.77, 22.75, 21.20 and 19.18 at 106, 123, 132, 146 and 163°. Di-Me maleate, b_D^{20} 102°, d_4^{25} 1.183–0.00112t, γ 37.31, 36.21, 34.12, 32.36, 29.95, 26.85 and 23.42 at 24, 35, 51, 67, 86, 113 and 143°, P 309.6.

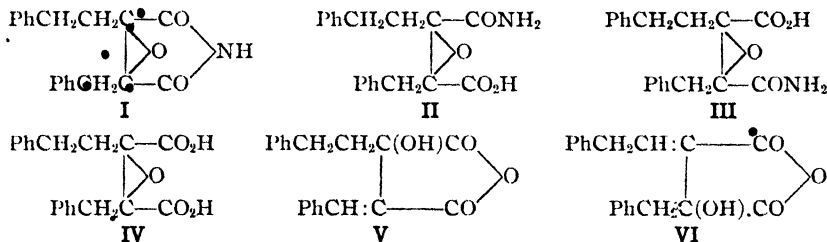
C. J. WEST

Bromo derivatives of *p*-methoxycinnamic acid. K. V. HARIHARAN AND J. J. SUDBOROUGH. *J. Indian Inst. Sci.* 8A, 189–219 (1925); cf. *C. A.* 17, 3021.—The present work was carried out to det. whether the generalizations drawn from the study of the Br derivs. of $\text{PhCH:CHCO}_2\text{H}$ hold also for those of $p\text{-MeOC}_6\text{H}_4\text{CH:CHCO}_2\text{H}$ (I). The β -ester (II) of I, m. 49–50°, b_D^{20} 245–55°, was obtained by allowing the oil obtained

from fresh rhizomes of *Kampharia galangal* to stand, a further amt. being obtained by distg. the residual oil under 10 mm. (yield of oil, 2.4-3.2% of the dry rhizomes; of **II**, about 30% of the oil). Free **I**, m. 170° to an opalescent liquid becoming translucent at 185°. Dibromide (**III**) of **I**, m. 149° (decompn.); dibromide (**IV**) of **II**, m. 111-2°. **I** and **II** combine with Br much more readily than PhCH:CHCO₂H and its esters; thus, at 4° in dry CCl₄ in diffused daylight 95% of **II** combines in 8 min. and only 3.4% of PhCH:CHCO₂Et. When 10 g. **IV** is allowed to stand with 3 mols. KOH in 250 cc. alc. at 25°, the amt. of KOH used up increases from 0.95 mol. in 5 min. to 2.00 mols. in 300 min. while the amt. of HBr formed is 0.95 and 1.00 mol. in 5 and 60 min., resp., and then remains const., indicating that the KOH is first used in removing HBr and then in hydrolyzing the resulting mono-Br ester to the free acid. With somewhat more than 1 mol. KOH at room temp., **IV** gives 97% of a *mono-Br ester*, yellow, b_s 168-70°; with somewhat more than 2 mols. KOH is formed 95% of a mixt. of mono-Br acids (**V** and **VI**), readily sepd. by means of their Ba salts; **V**, from the insol. Ba salt (85% of the mixt.), m. 184-5°, and **VI**, forming a sol. Ba salt, yellow, m. 102-3°. With PhNMe₂ in 92% alc. **IV** after 5 min. at room temp. gives a practically pure mono-Br ester, with elimination of 1.00 mol. HBr, but on boiling 25-180 min. about 1.25 mols. HBr are eliminated and the recovered ester contains only 21.8% Br, indicating that it is a mixt. of approx. 77% MeOC₆H₄CH:CBrcO₂Et, 16% MeOC₆H₄C:CCO₂Et and 8% **II**; hydrolysis of this ester with cold alc. KOH gives 80.7 and 9.3%, resp., of **V** and **VI**. *p*-MeOC₆H₄C:CCO₂H (**VII**), obtained in 96% yield from **V** with 2.1 mols. KOH in boiling alc., m. 135-40° (decompn.). The Me ester, m. 118-9°, of **III**, treated like **IV** above, gives 59.4 and 37.6%, resp. of **V** and **VI**; similar results are obtained with KOH in MeOH instead of EtOH. Refluxed 15 min. in H₂O, **III** gives about 85% MeOC₆H₄CH:CHBr (**VIII**) (**III** → HBr + CO₂ + **VIII**) and 6% **I** (**III** → Br₂ + **I**). The influence of temp. (-10° to 35°), concn. of KOH (0.16-3.5 N) and concn. of the alc. (92-85%) on the action of alc. KOH on **III** has been studied; the yield of **VIII** ranged from 53% (with N KOH in 95% alc. at -5° to -10°) to 75% (0.5 N KOH in 92% alc. at 25-35°) and at the same time was formed an *acid* (**IX**), isomeric with **V** and **VI** (yield, from 20% with 0.5 N KOH in 92% alc. at 25-35° to 40% with N KOH in 95% alc. at -5° to -10°). **IX** seps. from dil. alc. in prisms with 0.5 H₂O crumbling in a vacuum desiccator to a fine powder m. 123° and forming a sol. Ba salt. The yield of **IX** is only slightly influenced by the concn. of the alc. or KOH, temp. being the most important factor. With 2 mols. PhNMe₂ in alc., **III** gives 60% **VIII** and 40% **IX**. **V**, **VI** and **IX** cannot be a PhCBr:CHCO₂H, as they are too resistant towards cold alkalis and, moreover, differ from the 2 β-Br acids prepd. in other ways. **VI** can be converted into **V** by sunlight, Br and 88% H₂SO₄ and **V** and **VI** are therefore probably the 2 stereoisomeric *p*-methoxy-α-bromocinnamic acids corresponding to the PhCH:CHBrCO₂H, m. 131° and the *allo* isomer, m. 120°, resp. **V**, **VI** and **IX** all give **VII** with boiling alc. KOH. Only **IX** gives a well-defined cryst. dibromide (in CHCl₃), m. 145°; **VI** is transformed into **V**, and the Na salt of **V** (with Br vapor) yields *tetrabromo-p*-methoxycinnamic acid, m. 117-8°. With neutral KMnO₄ **IX** gives 12% of anisaldehyde. The mono-Br ester obtained by removal of HBr from **IV** also yields a *dibromide*, m. 106-8°. The Et ester of **IX**, obtained by the usual method of esterification, is an oil evolving HBr with Br in CHCl₃. With aq. KOH at 73.2°, **V** reacts about 3 times as fast as **VI** or **IX**; at 30° the reaction is too slow for velocity detns. and at 100° there is a tendency to the elimination of CO₂ and the formation of MeOC₆H₄C:CH. The addn. of 1 Br to **VII** varies with the temp. and the solvent. At 0° with aq. HBr (d. 1.78-1.80) 72-84% of an acid (**X**) with 30.5-1.2% Br and 5-10% of MeOC₆H₄COME are formed; the acid product is not homogeneous and readily loses CO₂ and HBr. If the temp. is allowed to rise to 25-35° during the addn. of the HBr, C₆H₅(C₆H₄OMe)₃, MeOC₆H₄COME and only a very small quantity of Br acids are formed. From 15 g. **X** in Me₂CO slowly allowed to evap. in a desiccator is obtained 7.7 g. *p*-methoxy-β-bromocinnamic acid (**XI**), yellow, m. 139-40°, dissolves clear in Na₂CO₃ but the soln. soon becomes turbid if not kept at about 0°; after 22 hrs. at 25°, the soln. yields 91% MeOC₆H₄C:CH and practically 100% HBr. The residues from the **XI**, freed from **XI** still remaining by allowing to stand with Na₂CO₃, then extg. with Et₂O and pptg. with HCl, give 3.9 g. of the *allo*-isomer (**XII**) of **XI**, m. 146° (the amt. of MeOC₆H₄C:CH recovered from the Et₂O ext. corresponds to 2.46 g. decompd. **XI**; the original 15 g. of **X** therefore, contained 67% **XI**). **XII** forms a readily sol. Ba salt, loses HBr less readily than **XI** and in sunlight tends to change into **XI**. *p*-MeOC₆H₄COME, m. 33-5°; *p*-bromophenylhydrazone, m. 131-2°. *Tri-p*-anisylbenzene, yellow, m. 169-70°, sol. in cold concd. H₂SO₄ with a greenish yellow fluorescence which disappears on diln. with H₂O, mol. wt. in camphor 377-85, gives with 2 parts Br in CHCl₃ a *penta-Br deriv.*, m. 242° (decompn.), and with

3 parts Br a hexa-Br deriv., m. 286° - 90° (dec. mpn.) (Schneider, *et al.*, *C. A.* **16**, 1248, claim to obtain from anisole and sulfoacetic acid *sym*- $C_6H_3(C_6H_4OMe)_3$, m. 142° ; repetition of their work gave a compd. m. $156-7^{\circ}$). From 5 g. VII in C_6H_6 suspension treated at $25-6^{\circ}$ with dry HBr are obtained 0.042 g. $MeOC_6H_4COMe$ and 7.11 g. acids, 60% of which is V and 38% is XII. *p*-Methoxy- α,β -dibromostyrene, from XI or XII in $CHCl_3$ with Br in the light or the dark, m. $90-1^{\circ}$. Attempts to prep. *p*- and *allo*-I from XII and Zn in alc. on the H_2O bath gave almost pure I. C. A. R.

Phenyl- α -hydroxycrotonamide. An example of the ether of ketone hydrate. J. BOUGAULT. *Compt. rend.* **180**, 1944-6 (1925); cf. *C. A.* **7**, 1486.—The product of the action of soda on phenyl- α -hydroxycrotonic amide is the amido acid, $PhCH_2CH_2C(OH)(CO_2H)OC(CH_2CH_2Ph)(OH)CONH_2$, contg. an ether grouping as a result of the dehydration between the hydroxyls of the ketone hydrate group. With $KMnO_4$ it gives an anide (I) and CO_2 . The reaction is very complex, involving a change in the linkage of the C atoms. I m. 120° and on prolonged boiling with soda, is decompd. into $PhCH_2CH_2COCO_2H$, $PhCH_2CH_2CO_2H$ and NH_3 . When dissolved in hot Na_2CO_3 until there is no turbidity upon cooling, I is hydrolyzed to the corresponding amido acid, (II) or (III), m. 170° . If the hydrolysis is continued with $NaOH$, the product is the dibasic acid IV, m. 204° . This action is reversible. IV when heated with Ac_2O for several min. at 100° , gives an anhydride m. 104° and regenerates IV with alkalis. If the heating with Ac_2O is prolonged for several hrs., there is obtained a different anhydride (V) or (VI), m. 75° , isomeric with the first, insol. in cold aq. Na_2CO_3 and slightly acid; dissolved in weak $NaOH$ and acidified with HCl , it regenerates the anhydride itself and not the IV. The Me ester m. 53° and, upon sapon. again yields the anhydride in large part. Na-Hg is without action upon IV, while it reduces the anhydride, yielding a new dibasic acid $PhCH_2CH_2CH(CO_2H)CH(CH_2Ph)CO_2H$, m. 170° .



H. W. GIBSON

Example of an ether of a ketone hydrate. Benzyl[phenylethyl]succinic acids. J. BOUGAULT. *Compt. rend.* **181**, 247-8 (1925).—The dibasic acid (I), m. 170° (preceding abstr.), obtained from the compd. $PhCH_2CH_2C(OH)(CO_2H)OC(CH_2CH_2Ph)(OH)CONH_2$ has been synthesized as follows: $PhCH:CHCH:C(CO_2H)_2$, from $PhCH:CHCHO$ and $CH_2(CO_2H)_2$, is reduced by Na-Hg to $PhCH_2CH:CHCH(CO_2H)_2$ which is isomerized by hot Na_2CO_3 to $PhCH_2CH_2CH:C(CO_2H)_2$ and the Me ester of this, heated in alc. with $NaCN$, gives $PhCH_2CH_2CH(CN)OH_2CO_2Me$, which on sapon. yields $PhCH_2CH_2CH(CO_2H)CH_2CO_2H$, m. 136° , whose Me ester, on condensation with BzH in Et_2O with Na , and subsequent sapon. yields benzal[phenylethyl]succinic acid (II), $PhCH_2CH_2CH(CO_2H)C(CO_2H)C(Ph)CO_2H$, m. 161° ; anhydride, obtained with Ac_2O , m. 100° and regenerates II on hydration. With Na-Hg II gives benzyl[phenylethyl]succinic acid (I) which, heated 15 min. with Ac_2O at 100° , forms an anhydride, m. 78° and regenerates I, but if the I is heated 24 hrs. with the Ac_2O it gives an anhydride, m. 74° , which on hydration gives an acid (III), m. 125° , isomeric with I. I and III are optically inactive but can be resolved into optical isomers by means of their strychnine salts, that of the *l*-acid being the more sol. in both cases. C. A. R.

Preparation of 6-methylcoumarin and its derivatives. T. J. THOMPSON AND R. HERBERT EDEE. *J. Am. Soc. Chem.* **47**, 2556-9 (1925).—6-Methylcoumarin (I) results in 80% yields by heating equimol. amts. of fumaric acid with 72% H_2SO_4 at $100-80^{\circ}$ for 2 hrs.; no I was formed when the 2 compds. were heated together, alone or with $ZnCl_2$, P_2O_5 , H_3PO_4 , Ac_2O or $AlCl_3$. I was also prepd. from *m*-homosalicylaldehyde and Ac_2O and from 6-bromocoumarin and MeI with Na . 6-Methylcoumaric acid, m. 118° ; the Na salt, light yellow, decomp. 275° ; the Ag salt turns black on exposure to light; the Ni salt is light green; K salt. I dibromide, m. $65-6^{\circ}$, giving I when boiled with H_2O . I $HgCl_2$, m. $189-90^{\circ}$. I chloroplatinate, light yellow, m. 63° . 6-Methyl-

thiocoumarin, yellow, m. 148°, from I and PS_3 ; the HgCl_2 salt, canary-yellow, m. 225° (decompn.) I.HI periodide, dark green iridescent crystals, decomps. on standing. KI periodide, brown, m. 89–90°. I dihydride, m. 225° (decompn.). No formulas or analyses are given. C. J. WEST

Data on cyclohexane. N. NAGORNOV AND L. ROTINJANZ. *Ann. inst. anal. phys. chim.* (Russ.) 2, 371–400(1924); *Chem. Zentr.* 1925, I, 1182.—The data involve detns. made before the World War. The cyclohexane which was used was prepd. by the method of Sabatier from C_6H_6 and after being carefully purified m. 6.54° and after expulsion of dissolved gases m. 6.63°. It b. 80.75°. The dependence of the sp. vol. v on the temp. t between 7 and 78° is expressed by the formula: $v = 1.26482/(1 - 0.0011599[t - 7] - 0.000008356[t - 7]^2)$, and the relation between the m. f , T_f and the pressure P in m. of Hg by the expression: $T_f = 6.63 + 0.0722 P$ between 0 and 156 m. of Hg and therefore $dP/dT_f = 13.85$. The sp. vol. of cryst. cyclohexane at 156 m. of Hg is expressed by $v = 1.1823 + 0.00081t$. From this the heat of fusion is calcd. by the Clausius-Clapeyron method to be 7.73 cal. per g. at 6.7°. The triple point is 6.63° at 40.0 mm. The crit. temp. T_c is 281.0°, the crit. pressure p_c 36.535 mm. The vapor pressure between -4.51° (20.55 mm.) and T_c are tabulated, a few values of which for solid and liquid C_6H_{12} are included in the following, which represent the temp. and the vapor pressure in mm. resp.: -1.02, 25.65; 2.27, 30.80; 4.03, 34.05; 6.14, 38.70; 6.90, 40.60; 10.03, 48.45; 12.10, 54.00; 16.10, 65.70; 19.78, 78.40; 35.40, 154.2; 45.34, 228.4; 55.33, 350.5; 64.44, 453.1; 75.37, 646.0; 120.25, 2155; 140.49, 3392; 160.31, 5070; 180.27, 7313; 200.35, 10,190; 220.58, 13,820; 240.38, 18,230; 260.89, 23,860; 275.95, 28,920. The van der Waal's factor f varied between 3.026 and 2.811. The vols. of the vapor and the liquid conform to the Cailletet-Mathias equation, the equation of "diameter": ($D_0 + D_{\text{apor}}$)/2 = 0.3942 - 0.0004331, from which the crit. vol. is calcd. to be 3.670. The coeff. of expansion at 80 m. of Hg pressure is 112×10^6 at 30–40°, 125×10^6 at 71–80°, 137×10^6 at 110–20°, 154×10^6 at 140–60°, 179×10^6 at 180–200°, 253×10^6 at 240–61°, and 339×10^6 at 285–301°. The compressibility at 49.90° is 149×10^6 at 26–53, 127×10^6 at 79–105, 116×10^6 at 158–84, m. of Hg pressure and at 160.31° is 413×10^6 at 26–53, 304×10^6 at 79–105 and 267×10^6 at 158–284 m. of Hg. The behavior of gaseous C_6H_{12} between 2456 and 5000 mm. of Hg pressure and between 140 and 285° conforms closely to the van der Waals equation. The law of the corresponding states holds true in the case of C_6H_{12} and for cyclopentane according to the data of Young. C. C. DAVIS

The specific gravity of hydrocarbons containing a methylene ring and a few other physical constants of acyclic compounds. A. USPENSKII. *Trans. Inst. Pure Chem. Reagents* 1924, No. 3, 5–17(Russ.); *Chem. Zentr.* 1925, I, 493.—Two regularities were noted in the dibromides of cyclohexane prepd. by U. (cf. C. A. 18, 1487) and in dibromobutanes. The b. p. of the dibromides increases with the relative distance between the 2 Br atoms and the d. decreases in the order: 1,2-, 1,4- and 1,3-dibromide. The bicyclic hydrocarbons prepd. from dibromocyclohexanes with a trimethylene ring have a higher d. than the isomeric olefins. Regarding the methylene ring as a double bond, it may be concluded in general that an increase in the d. of isomeric hydrocarbons accompanies an increase in the size of the ring. If by removal of 2 H atoms, the C atom 1 of hexane is combined with the C atom 2, with the C atom 3, etc., compds. are obtained which have progressively higher d. C. C. DAVIS

Transformation of dialkylcyclohexenones into dialkylbenzenes. E.-E. BLAISE AND M. LLE. M. MONTAGNE. *Compt. rend.* 181, 122–4(1925).—Methylethylcyclohexenone (made from dipropionylpropane) heated 4 hrs. at 100° with concd. HBr in a sealed tube gave *o*- $\text{MeC}_6\text{H}_4\text{Et}$, $d_4^{24.7}$ 0.8786, $n_D^{24.7}$ 1.50198, identified by oxidation to *o*- $\text{C}_6\text{H}_4(\text{CO}_2\text{H})_2$. A. W. FRANCIS

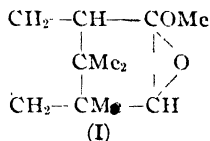
A new racemic menthone and the two corresponding stereoisomeric menthols. PIERRE BEDOS. *Compt. rend.* 181, 117–9(1925); cf. C. A. 18, 1990 and *Compt. rend.* 175, 1411(1922).—The action of Me_2CHMgBr upon the oxide of Δ^3 -methylcyclohexene, and upon 2-chloro-3-methylcyclohexanol (made from Δ^3 -methylcyclohexene with NH_2CONH_2) gives 2 new stereoisomeric menthols characterized by their allophanates m. 177° and 133°. The former menthol b_{14} 92°, d_{20}^{20} 0.901, n_D^{20} 1.45786; phenylurethan, m. 109–10°. Both menthols with CrO_3 give a menthone, b_{13} 81–2°, d_{18}^{16} 0.891, n_D^{16} 1.444. Reduction of its oxime, b_{10} 124–5°, d_{13}^{13} 0.9502, n_D^{13} 1.4787, gives a menthylamine, b_{10} 79–80°, d_{15}^{25} 0.849, n_D^{25} 1.45116. This gives a phenylurea deriv., m. 122°. A. W. F.

Camphor series. V. SHIGERU KOMATSU AND MASAO KURATA. *Mem. Coll. Sci. Kyoto Imp. Univ.* 9A, 23–8(1925); cf. C. A. 19, 2901.—It had already been noticed,

in the study of the Beckmann rearrangement of menthone oxime (C. A. 18, 2149), that the menthone is partially inverted when the oxime is hydrolyzed in the presence of reduced Cu at 200°, and K. and K. now find that a menthone with $[\alpha]_D - 26.34^\circ$ passed, resp., through a glass tube (at 300–5°), a quartz tube and a glass tube containing reduced Cu (at 200°), gives a product containing 4.57, 5.68 and 51.64% *d*-isomenthone. They agree with Beckmann that the inversion is due to a keto-enolic change of the grouping $-\text{CH}_2\text{CO}-$ which can be brought about to a small extent by alk. substances liberated from the glass during the heating but more readily by the contact action of the reduced Cu. If the menthone is heated to 300° with the reduced Cu, it yields 70% thymol, 22% cymene and 3% menthene; at high temps., therefore, the Cu acts like Ni, splitting off H from the C atoms of the hexamethylene ring. C. A. R.

The preparation of active isoborneol. G. VAVON AND P. PEIGNIER. *Compt. rend.* 181, 183–4 (1925).—Previous yields of isoborneol have been only 0.3% (from camphor). V. and P. oxidized the Mg deriv. of pinene-HCl, obtaining a mixt. of borneol and isoborneol. This was sepd. by converting to phthalic esters and partial hydrolysis, the borneol phthalate hydrolyzing much faster. Recrystn. and hydrolysis gave 7% of pure isoborneol. Another method was the catalytic hydrogenation of camphor using Pt black, giving 0.9 parts isoborneol and 0.1 part borneol. The same purification was used. The optical rotation of the product from pinene was -34° , from camphor $-35^\circ 40'$. A. W. FRANCIS

Camphane series. XL. Constitution of Manasse's hydroxycamphor. M. O. FORSTER AND P. P. SHUKLA. *J. Chem. Soc.* 127, 1855–60 (1925); cf. C. A. 15, 2859.—F. and S. confirm Karrer and Takashima (C. A. 19, 2333) that the Me ether of α -hydroxycamphor is a cycloacetal but propose I as its structure. The Manasse's β -hydroxycamphor is I with the Me replaced by H, while his α -deriv. is probably that substance associated with a variable amt. of the stereoisomer in which the HO group and H atom both occupy the alternate plane. Reduction of camphorquinone with Zn and AcOH gives 80%, or with Al-Hg 85% of a product m. 203–5°; the higher melting form (215°) has only been obtained by hydrolyzing the solid Me ether. On treating separately the crude product of reducing camphorquinone, α -hydroxycamphor or β -hydroxycamphor with excess of MeMgI, the quant. amt. of CH_4 required by 1 OH group was liberated in each case and the original product was recovered unchanged; the Me ether is unaltered by the Grignard reagent without liberating CH_4 . The higher melting hydroxycamphor gives a *II* phthalate, m. 161–5°, $[\alpha]_D 53.7^\circ$ (dil. EtOH); the lower melting form gives a product, m. 152–6°, which was resolved into the compd. m. 164–5° and an isomeric one, m. 147° $[\alpha]_D 42.2^\circ$. Hydrolysis appears to yield an equil. system of the 2 parents. C. WEST



Search in the diphenylmethane series for the isomerism characteristic of certain diphenyl derivatives. C. L. BUTLER, JR. AND ROGER ADAMS. *J. Am. Chem. Soc.* 47, 2610–20 (1925).—The expectation that the isomerism characteristic of the Ph_2CH_2 series came from a consideration of the fact that $(4\text{-H}_2\text{NC}_6\text{H}_4)_2\text{CH}_2$ (I) forms a cyclic compd. with CS_2 similar to that formed from $(\text{H}_2\text{NC}_6\text{H}_4)_2$. Carbonyl-4,4'-diaminodiphenylmethane, pale yellow, m. above 340°, results from I and COCl_2 in CHCl_3 . I and $(\text{CO}_2\text{H})_2$ probably give the corresponding oxalyl deriv., grayish, m. above 340°. I and $\text{C}_6\text{H}_4(\text{CO})_2\text{O}$ give 4,4'-diphthalimidodiphenylmethane, m. 327°. $\text{CH}_2(\text{C}_6\text{H}_4\text{N}_2\text{Cl}_2)$ and $\beta\text{-C}_{10}\text{H}_7\text{OH}$ give the compd., $\text{C}_{33}\text{H}_{24}\text{O}_2\text{N}_4$, red, m. 250–60°, no matter in what proportions the reagents are used. Two mol. eqvs. of naphthionic acid (II) gave the red dye $\text{C}_{33}\text{H}_{24}\text{O}_2\text{S}_2\text{N}_4$, does not m. below 340°; with 1 mol. II, there results a black intermediate product, which on boiling with alkali yields Na 4-azonaphthionate-4'-hydroxydiphenylmethane, red, does not m. below 340°; this black ppt. also couples with $\beta\text{-C}_{10}\text{H}_7\text{OH}$, giving the red dye, $\text{C}_{33}\text{H}_{24}\text{O}_2\text{N}_4\text{S}_2$. This diazo compd. differs from that of $(\text{H}_2\text{NC}_6\text{H}_4)_2$ in that it is impossible to cause 1 diazo group to couple quant. before the other diazo group reacts. Nitration of I gives the 2,2'-di- NO_2 deriv., the acid sulfate of which crystallizes from dil. H_2SO_4 (m. 228–9°); from EtOH the normal sulfate, m. 235–6°, seps. The free base m. 211–2°; with $\text{C}_6\text{H}_4(\text{CO})_2\text{O}$ it gives the 4,4'-diphthalimido deriv., buff-colored, m. 250°. 3,3'-Dinitro-4,4'-diphthalimidodiphenylmethane, yellow, m. 311°. Various transformations were carried out but no isomeric derivs. could be obtained. Dibrucine diphenylmethane-2,2'-dicarboxylate, m. 180–2° (decompn.), $[\alpha]_D -27.30^\circ$ in CHCl_3 ; the acid from this salt was inactive. 2,2'-Dicarboxy-4,4'-dinitrodiphenylmethane, pale yellow, m. 237–8°; the dibrucine salt, m. 210° (decompn.), $[\alpha]_D -6.5^\circ$ in CHCl_3 ; the free acid from this salt was also optically inactive. Mononitro-2,2'-dicarboxydiphenylmethane, pale yellow,

m. 284–5°. The *dibrucine* salt of 2,2'-dinitro-4,4'-dicarboxydiphenylmethane, m. 136–41° (decompn.), $[\alpha]_D$ –2.47° in CHCl_3 ; it gave an inactive acid. Thus, none of the acids could be resolved. C. J. WEST

Action of organomagnesium compounds on naphthoquinones. I. Action of phenylmagnesium bromide on α -naphthoquinone. A. FRANSSEN. *Bull. soc. chim.* 37, 902–13(1925).—F. intends to fill in the gap in our knowledge of the action of Grignard reagents on quinones, this action having already been studied for benzoquinones, anthraquinone and phenanthrenequinone. From PhMgBr and α -naphthoquinone (I) was obtained a complex reaction product contg. 1,4-dihydroxy-1,4-diphenyl-1,4-dihydronaphthalene (II), PhOH , and Ph_2 in low yields and a mixt. (III) of highly colored products from which F. obtained neither the possible quinol, which probably underwent subsequent transformations, nor unattacked I. The presence of PhOH shows that the PhMgBr must have acted as a reducing agent. There was at least 1 Mg compd. in III. F. changed the proportions of the reacting substances so as to get more of II. The reaction of PhMgBr on 32 g. I occurs in 2 stages and gives 48 g. crude powder, which yields 25% of its wt. of II, m. 207–8° (uncor.), sol. in hot AcOH to the extent of 8 or 9%, and in hot HIOAc and in hot alc. to about 4%, and contains no CO group, since it is not reduced by HI . From 1 g. II is obtained, on reduction, 0.35 g. 1,4- $\text{C}_{10}\text{H}_8\text{Ph}_2$ (IV), m. 308°. From 1.07 g. II, Ac_2O , and H_2SO_4 is obtained 1.02 g. 1-acetoxy-2,4-diphenylnaphthalene (V), m. 163° (uncor.). In this reaction, II loses 1 mol. H_2O , changing from the quinone to the naphthalenic form; the remaining HO group is then acetylated. By the sapon. of V is obtained, nearly quant., 2,4-diphenyl-1-naphthol, m. 143–4°. No di-Ac deriv. of II could be obtained, nor was methylation with CH_3I successful, probably because of steric hindrance. Oxidation of II gave, instead of the expected *o*- $\text{Bz}_2\text{C}_6\text{H}_4$, 1 mol. *o*- $\text{BzC}_6\text{H}_4\text{CO}_2\text{H}$, 1 mol. BzOH , and a compd. m. about 240°. Oxidation of V gave the same products. MARGARET W. MCPHERSON

Preparation of symmetrical polynitrodinaphthyls from halogenonitronaphthalenes by the use of copper dust. L. K. CHUDOSILOV. *Chem. Listy* 19, 187–90(1925).—Ullmann (*Ann.* 332, 38) employed Cu dust in the condensation of halogenbenzene derivatives to derivatives of Ph_2 . C. finds that the method can be used in the prepn. of derivatives of $(\text{C}_{10}\text{H}_7)_2$ provided a nitro group is present in a neighboring position to the halogen on the C_{10}H_8 nucleus. If the nitro group is further removed from the halogen, the reaction proceeds appreciably only at temps. at which the original compds. begin to decomp., and hence, the yield is very much lowered. The following compds. were prepd.: 2,2-dinitro-1,1-dinaphthyl, m. 179–80°; 2,2-diamino-1,1-dinaphthyl, m. 187°; 1,1-dinitro-2,2-dinaphthyl, m. 264–5°; 1,1-diamino-2,2-dinaphthyl, m. 253–9°; 4,4-dinitro-1,1-dinaphthyl, m. 236–7°; 3,3-dinitro-1,1-dinaphthyl, m. 142–3°; 2,2,4,4-tetranitro-1,1-dinaphthyl, m. 291–2°. FRANK C. KRACEK

Acenaphthene series. II. α -Aminoacenaphthene. C. TO MORGAN AND A. D. SHENASBY. *J. Soc. Chem. Ind.* 44, 408–10T(1925); cf. C. A. 19, 651.—Substitution in the acenaphthene system usually takes place para to one of the methylene groups, but this is perhaps preceded by ortho. Nitrating agents involving H_2O_2 and strong mineral acids give a *p*-product; the use of reagents which avoid the presence of the above-mentioned compds. produces *o*-substitution. Acenaphthene and benzoyl nitrate in cold petr. ether gave the *o*-nitro deriv. as the sole product. Fuming HNO_3 and a large excess of Ac_2O (acetylnitric acid) gave 65–70% of *o*-compd.; the remainder of the product, the *p*-substance, is due to a secondary reaction. This was established by heating *o*-nitroacenaphthene (I) with a little HNO_3 in glacial HOAc , and also by heating it with H_2SO_4 in the same solvent. There is some indication that the reaction is reversible, but if so the equil. is well toward the *p*-side. I, yellow, m. 68°. By $\text{Na}_2\text{S}_2\text{O}_4$ I is converted into *o*-aminoacenaphthene (II), colorless, m. 92° (52% yield). This was distinguished from the *m*- and *p*-isomers by mixed m. p. detns. II gave a *picrate*, with 1 mol. of acid for each mol. of amine, yellow, decompg. 180–200°. NH_4OH liberated the base. The HCl salt of II, m. 250–60°. Diazotized in dil. acid, II gives a blue-green soln., and thus is like the *p*-, but different from the *m*-compd. Aq. FeCl_3 produces an emerald-green color, but in alc. the color is deep violet. With AcCl , II yields colorless *o*-acetylaminacenaphthene, m. 168° (yield 60%). By a Schotten-Baumann reaction II gives *o*-benzaminoacenaphthene, m. 208° (yield, 60%). With *p*- $\text{O}_2\text{NC}_6\text{H}_4\text{N}_2\text{OAc}$, II produces dark purple 4-nitrobenzenazo-*o*-aminoacenaphthene, pptd. by NH_4OH ; yield, 95%. This, and a similar product from the *p*- NH_2 isomer, is to be further investigated. G. A. HILL

Halogen derivatives of diphenylmethane. A. E. CHICHIBABIN AND A. A. SHESLER. *J. Russ. Phys. Chem. Soc.* 56, 149–52(1925).—Following the discovery (C. A. 5, 1761) of a convenient method for reducing di- and triphenylcarbbols by means of HI glacial

acetic acid, C. and S. saw an easy way of prep^g. halogen derivs. of CH_2Ph_2 by utilizing this method. *Prepn. of $p\text{-ClC}_6\text{H}_4\text{CHPhOH}$* .—To 39 g. PhBr in 122 cc. abs. ether, 6 g. of MgO was added and to the org. Mg compd. thus formed a soln. of 25 g. $p\text{-ClC}_6\text{H}_4\text{CHO}$ was added drop by drop under cooling by snow. A vigorous reaction took place and the resulting paste-like mass, decompd. with small pieces of ice and treated with dil. HCl , formed 2 liquid layers. The ethereal layer, repeatedly washed with water, dried and evapd. left a yellowish butter-like substance which, on being rubbed with a glass rod, soon crystd. On pressing the product on porous plates 34.9 g. of crude $p\text{-ClC}_6\text{H}_4\text{CHPhOH}$ was obtained which, on being recrystd. from ligroin, m. 61° , sol. in H_2SO_4 with an orange color. *Prepn. of $p\text{-ClC}_6\text{H}_4\text{CH}_2\text{Ph}$ by reducing $p\text{-ClC}_6\text{H}_4\text{CHPhOH}$* .—Ten g. of the carbimol in hot glacial AcOH and an excess of AcOH satd. with HI were boiled about 3 min., and poured into water contg. a little Na_2SO_3 . The butter-like substance obtained gave on extn. with ether, 8.7 g. of a pink-yellow residue which did not give any color with concd. H_2SO_4 , b_{11} 160° and 7.5° . *Prepn. of $\text{ClC}_6\text{H}_4\text{CHPhOH}$* .—In the same way using *o*- instead of $p\text{-ClC}_6\text{H}_4\text{CHO}$, C. and S. obtained 24.2 g. *o*- $\text{ClC}_6\text{H}_4\text{CHPhOH}$, m. $65\text{--}5.5^\circ$, sol. in H_2SO_4 with an orange color. *Reduction of $o\text{-ClC}_6\text{H}_4\text{CHPhOH}$ (10 g.)*.—Like the p -compd. gave 8.8 g. crude or 7.5 g. of pure *o*- $\text{ClC}_6\text{H}_4\text{CH}_2\text{Ph}$, b_{19} 164.5° , m. 13.2° . *Prepn. of $m\text{-ClC}_6\text{H}_4\text{CHPhOH}$* .—(21 g. from 28.8 g. PhBr, 3.6 g. Mg and 18.5 g. $m\text{-ClC}_6\text{H}_4\text{CHO}$), m. 38° , sol. in H_2SO_4 with an orange color. B. NELSON

New chlorocarbonates derived from aromatic and dihydroxy alcohols. R. E. OESPER, WALTER BROKER AND W. A. COOK. *J. Am. Chem. Soc.* **47**, 2609–10 (1925).—The yields of chlorocarbonates, obtained by the action of COCl_2 upon certain tert. bases, followed by alcs., is 40–60%, not theoretical as claimed in the patents. The yields obtained when a base is slowly added to a non-aq. soln. of equiv. amts. of COCl_2 and an alc. are 75% or better. New chlorocarbonates prepd. are: *o*-chlorophenyl, b_{27} 113° ; carbamate, m. 142° ; p -deriv., b_{30} 114° ; m -nitrophenyl, b_{18} 158° ; α -naphthyl, b_6 132° ; ethylene bis-, b_{37} 122° ; trimethylene bis-, b_{41} 135° ; carbamate, m. 167° ; m -phenylene bis-, b_{30} 155° , m. 46° ; p -phenylene bis-, m. 100° . Bis- m -nitrophenyl carbamate, straw-colored, m. 168.5° . *o*-Tolyl carbamate, m. 160° . C. J. WEST

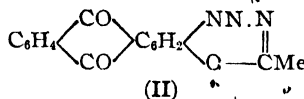
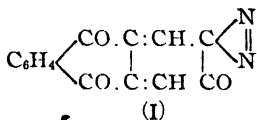
Some derivatives of 4-chloroanthracoumarin. V. I. MINAYEV. *J. Russ. Phys.-Chem. Soc.* **54**, 829–32 (1924).—4-Anilinoanthracoumarin, $\text{C}_{22}\text{H}_{13}\text{O}_2\text{N}$ 0.5 g. chloroanthracoumarin in excess (0.5 g.) freshly distd. PhNH_2 in presence of catalytically active $\text{Cu}(\text{OAc})_2$ (0.05 g.) and HCl and KOAc (0.25 g.) is refluxed 1.2 hrs. The soln. acquires an intense violet-red color. Formation of KCl on the walls of the flask serves as evidence that the reaction is proceeding. The reacting mixt. is treated boiling hot with an excess of pure dil. HCl , the product is sucked dry, washed with boiling water and dried. The violet powder which is obtained can be recrystd. from 96% alc. Yield, 0.3 g. 4,4'-Dianthracoumarinil. 0.4 g. chloroanthracoumarin, 0.12 g. mol. Cu and 1.8 cc. PhNO_2 are boiled 2 hrs., and then dild. with PhNO_2 . On cooling the dark red soln. is filtered, the ppt. washed with alc. on the filter and boiled several times in dil. HNO_3 to free it from Cu . Yield, 0.13 g. Structural formulas for both compds. are given. A. C. CACHLIN

Reduction products of the hydroxyanthraquinones. VI. A. G. PERKIN AND GEN YODA. *J. Chem. Soc.* **127**, 1884–8 (1925); cf. C. A. **18**, 1662.—Tetraacetyldihydroxydianthranol is oxidized by I in $\text{C}_6\text{H}_6\text{N}$ at 80° , giving 3,6'-diacetoxydianthraquinone (I), pale yellow, m. $293\text{--}5^\circ$ when crystd. from Ac_2O or $314\text{--}6^\circ$ after repeated crystn. from $\text{C}_2\text{H}_5\text{Cl}_4$. The warm solns. have a green color, fading on cooling. A C_6H_6 soln., exposed to light for 5 weeks, gives a pale yellow compd., m. above 350° , which may be diacetoxyanthradianthrone. Hydrolysis of I in EtOH with 10% NaOH gives the di- HO deriv. (II), pale yellow, which becomes black at 280° but does not show a definite m. p. Alkalies give an orange-yellow color fairly permanent in the air. H_2SO_4 gives a maroon liquid quickly passing to brownish black, from which H_2O ppts. a brown-black compd., sol. in alkali with a similar color. This is reduced by $\text{Na}_2\text{S}_2\text{O}_4$ to an orange-yellow liquid which quickly oxidizes in air. The boiling NH_4OH soln. is reduced by Zn and with Ac_2O yields 3-acetoxyanthranol. II (0.2 g.) in abs. EtOH on exposure to light becomes orange and after 6 weeks deposits a mixt. of products, which after acetylation gives 0.1 g. diacetoxyanthradianthrone (III), m. above 350° , and a little diacetoxyanthradianthrone, m. $275\text{--}9^\circ$. II becomes orange in the light after a few hrs. II (1 g.) in 25 cc. H_2O is oxidized by $\text{K}_3\text{Fe}(\text{CN})_6$ in NaOH to a red ppt. (1.03 g.), which on acetylation gives 0.97 g. III. Di- Br deriv. of II, yellow, darkens 295° , m. $301\text{--}2^\circ$ (green liquid). Di- MeO deriv. of II, yellow, turns green at 270° , m. $297\text{--}9^\circ$; it turns orange on exposure to light. Exposure in Me_2CO to the light gives unchanged di-

MeO deriv. and dimethoxynaphthodianthrone (?), does not m. 340°, and gives a red color with concd. H_2SO_4 .

C. J. WEST

The quinonediazides of the anthraquinone series. MUNCNARI TANAKA. *Compt. rend.* **181**, 180-2 (1925).—0.5 g. of 2-diazo-3-nitroanthraquinone in 25 cc. Ac_2O heated gradually* to 95° and cooled quickly gave 9,10-anthraquinone-2,3-quinonediazide (I), crystg. with 0.75 mol. Ac_2O , unstable, couples with R-salt to a blue dye, evolves gas with $PhNHNH_2$, is sensitive to NaOH. Gentle heating with $Na_2S_2O_8$ and NaOH gave 2-hydroxyanthraquinone-3-hydrazine, brownish red. This boiled with Ac_2O gave 2-methyl-5,6-anthraquinone-1,3,4-diazine (II). The prepn. and properties of 9,10-anthraquinone-1,2-quinonediazide were similar to those of its isomer above.



A. W. FRANCIS

Wandering of the acetyl group during methylation. ONRO KUBOTA AND A. G. PERKIN. *J. Chem. Soc.* **127**, 1889-96 (1925); cf. Oesch and P., *C. A.* **9**, 2894.—The action of CH_3N_2 upon acetylalizarin gives 80% of 2-methoxy-1-acetoxyanthraquinone, yellow, m. 204-6°, which upon hydrolysis with HCl-AcOH gives the orange-red alizarin 2-Me ether, m. 229-30°. There is also formed a small quantity of the 1-Me ether previously described. Diacetylalthragalol (I), yellow, m. 223-4°; some tri-Ac deriv. is also formed and in the impure state m. 175-80°. Methylation of I by CH_3N_2 gives a mixt. of anthragalol 2-Me ether, yellow, m. 218-20° (Ac deriv., yellow, m. 152-4°) and the 1-Me ether, red, m. 239-11° (Ac deriv., yellow, m. 203-5°); the 1st ether gives a scarlet alk. soln., the latter deep blue. Tetraacetylquercetin, m. 185-90°; CH_3N_2 , followed by hydrolysis, yields quercetin 5-Me ether, m. 305-8° (tetra-Ac deriv., m. 202-4°); K salt, lemon-yellow needles. Hydrolysis with MeOH-KOH gives m-HOC₆H₄OMe. Methylation of the HO group has no influence on the tinctorial properties of quercetin

C. J. WEST

Constitution of picrotoxin. M. BAKUNIN AND F. GIORDANI. *Rend. accad. sci. fis. mat. Napoli* [iii], **30**, 166-74 (1924).—Thermal analysis of the system picrotoxin-picrotoxinin (cf. Barth von Bartsch and Kretschy, *Wien. Akad. Ber.* [2 Abt.] **81**, 7-44 (1881); *Monatsh.* **2**, 796-809 (1882); Paternò and Ogliarolo-Todaro, *Gazz. chim. ital.* **10**, 36-52 (1881); Schmidt, *Ann.* **222**, 312-52 (1884); Paternò and Nasini, *Gazz. chim. ital.* **16**, 262-75 (1886); Meyer and Bruger, *Ber.* **31**, 2958-74 (1898); Sielisch, *C. A.* **6**, 3450; **7**, 345; Horrmann, *C. A.* **6**, 2923) indicates clearly the existence of a compd. contg. about 40% of picrotin. The optical activities of mixts. of the 2 compds in abs. alc. lie almost exactly on a straight line, mixts. contg. about 40% of picrotin appearing to show very slight divergences. If picrotoxinin has the formula $C_{65}H_{110}O_6$, the hydrate would contain either 5.8% or 3.94% of water, according as its compn. is $C_{65}H_{110}O_6 \cdot H_2O$ or $3C_{65}H_{110}O_6 \cdot 2H_2O$; B. and G. find 5.01-5.64%, while Schmidt (*loc. cit.*) gave 4.67-5.59%. As intermediate figures are obtained for the % of MeOH in the crystals contg. it, it remains uncertain whether the hydrate and the Me alcoholate are mixts. or whether the mol. of picrotoxinin is somewhat greater than is represented by the above formula.

B. C. A.

Synthesis of a tetrapyrrole and several derivatives of 2,3-dimethylpyrrole. HANS FISCHER AND HANS BELLER. *Ann.* **444**, 238-48 (1925).—2,3-Dimethyl-4-carbethoxypyrrole (I g.) in 15 cc. EtOH and 3 cc. 10% EtOH-($CHCl_3$)₂ heated with 6-8 drops concd. HCl 2 min., give 80% of tetra-[2,3-dimethyl-4-carbethoxypyrroly]ethane, m. 238.5°, mol. wt. in camphor, 651, turns red in the light or on warming in AcOH. Oxidation gives II. Heated with $AlCl_3$ in CS_2 there results the corresponding ethylene, yellow, m. 229°, mol. wt. in camphor, 601, 661; HCl changes the yellow $CHCl_3$ soln. red. It decolorizes alk. $KMnO_4$; in $CHCl_3$ it shows absorption in the violet from γ 462.9; treated with HCl there are bands from λ 557.1-524.1. 2,3-Dimethyl-4-carbethoxy-5-formylpyrrole (I), m. 129°; oxime, m. 140°; semicarbazone, m. 212°; rhodanide, m. 242°. Sapon. with NaOH gives the free acid, decomps. 259°, which, heated at 140 mm. and 280°, gave 5% of 2,3-dimethyl-5-pyrrolaldehyde, m. 126°. 2,3-Dimethyl-4-carbethoxy-5-acetylpyrrole, m. 129-30°. 2,3-Dimethyl-5-acetylpyrrole, m. 112.5°. Bis-[2,3-dimethyl-4-carbethoxypyrroly]-5-methane, m. 180° (nearly quant. yield). I and 2,3-dimethyl-4-carbethoxypyrrole, condensed by HCl, give bis-[2,3-dimethyl-4-carbethoxypyrroly]methene-HCl (II), red, m. 163°; in AcOH there is an absorption band

from λ 559.9 to 465.8, in the violet from λ 417. The free *methene*, red, *m.* 156°; in Et_2O it absorbs the blue part of the spectrum from λ 517; in AcOH from 551–508.7 and also 484. *Cu salt*, dark metallic glistening needles, showing absorption bands in very dil. CHCl_3 soln. at λ 570.3–544 and 516.5–485.3; on addn. of AcOH bands appear at 550.5–512 and 485.4. The *methene* was obtained from the *methane* by boiling with FeCl_3 in EtOH . *Bis*-[2,3-dimethyl-5-carbethoxy-pyrryl]-4-methane, *m.* 207–8°.

C. J. WEST

The decomposition of pyrazolines by spontaneous oxidation. R. LOCQUIN AND R. HEILMANN. *Compt. rend.* 181, 120–2 (1925); cf. Maire, *C. A.* 2, 1824—Pyrazolines are decompd. by dry O with production of N_2 and ketones. Lower pyrazolines give unsatd. ketones, e. g. mesityl oxide, but higher ones satd. ketones according to the

scheme, $\begin{array}{c} \text{RCH} \cdot \text{CH}_2 \cdot \text{CR}' \\ | \quad \quad | \\ \text{NH} \quad \quad \text{N} \end{array} + \text{O} \rightarrow \text{RCH}_2\text{CH}_2\text{COR}' + \text{N}_2$. The mechanism of the reaction is being investigated.

A. W. FRANCIS

4- and 5-Nitro-1,2-dimethylglyoxalines. V. K. BHAGWAT AND F. L. PYMAN. *J. Chem. Soc.* 127, 1832–6 (1925); cf. *C. A.* 18, 3190.—Nitration of 1,2-dimethylglyoxaline (I) gives 22% unchanged I, 20% of the 4-nitro deriv. (II) and 10% of the 5-nitro deriv. (III); the methylation (Me_2SO_4) of 4(5)-nitro-2-methylglyoxaline gives 1.1% of II and 57% of III. II *m.* 182–3° (all *m.* ps. are cor.); *HCl salt*, *mp.* 175°, *m.* 215° (decompn.); it dissociates on heating at 100° or with H_2O ; the base does not yield a picrate. III *m.* 138–9°; *HCl salt*, *m.* 195° (decompn.); it is not dissociated by H_2O and remains unchanged in *m.* p. after prolonged heating at 100°; *picrate*, yellow, *m.* 162–3°. III and MeI at 100° or II and MeI at 150° give 4(5)-nitro-1,2,3-trimethylglyoxalinalinium iodide, bright yellow, *m.* 195–6° (decompn.); *distd.* at 33 mm., 67% II is obtained from the distillate. Neither II nor III condenses with BzH at 155–60°. Reduction of III with SnCl_2 and concd. HCl gives a small amt. of a base, $\text{C}_8\text{H}_{10}\text{N}_2$, whose *picrate*, *m.* 142–5°, NH_4Cl , MeNH_2 and $\text{H}_2\text{NCH}_2\text{CO}_2\text{Et}$. Reduction of 5(4)-bromo-4(5)-nitro-2-methylglyoxaline with H_2S and NH_4OH gives an almost quant. yield of 4(5)-nitro-5(4)-thiol-2-methylglyoxaline, yellow, *m.* about 260° (decompn.), first isolated as the NH_4 salt, deep yellow, darkens 190°, becomes black at 210° and yields NH_3 with aq. NaOH . The base is sol in 5 *N* HCl but soon deposits the pale buff *HCl salt*, *m.* about 260° (decompn.). Heating 5-nitro-1,4-dimethylglyoxaline (V) with MeI under the reflux or 4-nitro-1,5-dimethylglyoxaline (IV) with MeI at 100° gives 4(5)-nitro-1,3,5(4)-trimethylglyoxalinalinium iodide, bright yellow, *crystg.* with 0.5 H_2O , *mp.* 134–5°; heating *in vacuo* until all the MeI is removed gives 83% of IV. IV dissolves in concd. HCl but after spontaneous evapn. in the air, the base remains. V. *HCl*, *m.* 188° (decompn.), slowly volatilizes at 100°; it is recovered unchanged after evapn. with H_2O .

C. J. W.

Lupine studies. IV. Isolation of *d*-lupanine from *Lupinus kingii* (S. Watson). J. F. COUCH. *J. Am. Chem. Soc.* 47, 2584–7 (1925).—The air-dried *Lupinus kingii* contains 10.5% H_2O and yields 0.83% of *d*-lupanine; its *chloroaurate*, yellow, *m.* 200° (decompn.); *HCl salt*, *m.* 127°; III salt, *m.* 183–5°; *methiodide*, *m.* 239–40°; *methyl-lupanine chloroaurate*, *m.* 204–5°. Two other alkaloids, $\text{C}_{15}\text{H}_{24}\text{ON}_2$, were isolated and analyzed as the Au salts. Crystallographic data for *d*-lupanine are reported by W. H. Fry.

C. J. WEST

Polysaccharides. XXXIII. Lichtotriose (KARRER, LIEB) 11A. A new series of organic compounds of tin (DRUCE) 6. Hydrogen magnesium halides (PICKENS) 6. Formation of organic from inorganic compounds under the influence of light (BAUDISCH) 3. Lithium arc spectrum for polarimetric use (AUSTIN) 3. Dissociation constant of methanol (BJERRUM, *et al.*) 2. Equilibrium diagrams and heats of formation in some binary organic systems (KITRAK) 2. Crystallography of methyl-diphenyl-methyldichloramine (FISHER) 2. Sulfuryl chloride. III. The influence of catalysts on the chlorination of toluene (SILBERRAD, *et al.*) 2.

HOLLEMAN, ARNOLD FREDERIK: A Textbook of Organic Chemistry. 6th English ed. rewritten. Edited by A. Jamieson Walker assisted by Owen E. Mott. New York: J. Wiley & Sons, Inc. 581 pp.

Acetic anhydride. CONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE GES. Brit. 230,063, Feb. 25, 1924. HOAc vapor is passed over a heated phosphate, preferably a metaphosphate of Na, K or Li, which may be mounted on a carrier e. g., Si or Si carbide. Max. activity of the catalyst is obtained by heating it to above 700°.

Concentrating acetic acid. H. SUIDA. Brit. 230,447, March 8, 1924. Aq. HOAc is vaporized and the vapors, superheated to about 150°, are treated with liquids which dissolve HOAc and are immiscible with H₂O, e. g., cresols, polyhydric phenols and their ethers, hydrogenated phenols and liquid fatty acids b. above 150°. HOAc is sepd. from the soln. by distn., preferably *in vacuo*. An app. is described. Cf. C. A. 19, 523.

Aminosulfonic acids. FARBENFABRIKEN VORM. F. BAYER & Co. Brit. 230,457, March 4, 1924. ω -Aminoalkylaminonaphthalenesulfonic acids are produced by the action of an aliphatic diamine, in the presence of a sol. sulfite, upon sulfonic acids of naphthols, naphthylamines, aminonaphthols, dihydroxynaphthalenes, or naphthalene-diamines. Ethylene-, propylene- or butylene- diamines may be used. Numerous examples are given.

Butyric acid. C. W. HANCOCK. Can. 249,808, May 19, 1925. Mn butyrate is added to butyraldehyde and the mass is distributed in a reaction space in countercurrent to O at a temp. of 21–40° to produce butyric acid.

Fatty acids. A. WELTER. Can. 251,708, July 14, 1925. A neutral fat is heated in the presence of any suitable splitting agent and the splitting is completed in the presence of an alkali.

Reduction of halogenated carbides. A. F. G. BELONE. Can. 250,594, June 9, 1925. CHCl₃ is formed by treating CCl₄ with Fe(OH)₂ in the presence of water and of a basic substance.

Purifying and deodorizing isopropyl alcohol. M. D. MANN, JR. and R. B. LEBOWITZ. Can. 251,295, June 30, 1925. ZnCl₂, 1 to 7 lb., is mixed with 1000 gals. of the alc., the mixt. is allowed to stand and the alc. is removed. From 5 to 10 lb. per 1000 gals. of alc. may be added and the alc. is then distd. off.

Methanol. O. SCHMIDT and J. UFER. Can. 251,486, July 7, 1925. CO or CO₂ mixed with a greater vol. of H is brought into contact with a catalyst at 200° and a pressure of at least 30 atm. The catalyst contains Cu and 1 or more of the elements Ti, V, Cr, Mn or B but is free from Fe or Ni.

Chlorination of methane. C. B. CARTER and A. E. COXE. Can. 251,733, July 14, 1925. A mixt. of CH₃Cl, CH₄ and Cl is passed through a reaction chamber at a temp. of 350–650°, the higher chlorination products are removed and the remaining CH₃Cl and CH₄ with a fresh supply of Cl is passed through the reaction chamber.

Perylene. C. H. MARSHALL. Can. 250,879, June 23, 1925. Phosphoric or phosphorous esters of β -dinaphthol or their derivs. such as their haloides are distd. in the presence of a metallic reducing agent. Cf. C. A. 19, 1284.

Perylene. A. ZINKE and H. SCHOEPPER. Can. 250,414, June 2, 1925. Dihydroxy-*perylene* is mixed with a pulverulent reducing metal and CaCl₂ and the mixt. is heated to distil off *perylene*.

Nitrating aromatic hydrocarbons. S. P. MILLER and J. R. HESS. Can. 251,731, July 14, 1925. Aromatic hydrocarbons in a molten state are introduced into cool H₂SO₄ and a nitrating agent is added.

Oxygenated organic compounds. M. PIER, M. MULLER, G. WIETZEL and K. WINKLER. Can. 251,485, July 7, 1925. A mixt. of C oxides and H is passed through active C to remove volatile S and Fe compds. from the mixt. and then subjected to the action of a catalyst under pressure.

Oxygenated organic compounds. A. MITTASCH, K. WINKLER and M. PIER. Can. 251,484, July 7, 1925. Methanol is produced by passing a mixt. of C oxides and H at elevated temp. and pressure over a catalyst contg. oxides of Zn and Cr, with an excess of ZnO. The product is sepd. from the gases by cooling.

Oxygenated organic compounds. M. PIER and C. MULLER. Can. 241,483, July 7, 1925. Methanol is produced by passing a mixt. of C oxides, one vol. with more than one vol. of H over a catalyst at elevated temp. and pressure. The catalyst may be a metal oxide non-reducible under the conditions of working.

Aromatic arsenic compounds. A. ALBERT. Can. 251,036, June 30, 1925. Aromatic As compds. contg. trivalent As and a carbonyl group are prepd. by treating an aromatic compd. which contains a carbonyl group in non-cyclical linkage and an arsenic acid group attached to the benzene ring with NaHSO₃. Cf. C. A. 18, 400.

Organic arsenic compounds. A. ALBERT. Can. 251,035, June 30, 1925. Org. As compds. are produced by diazotizing amidized org. substances contg. a carbonyl group in acyclical linkage and treating with arsefite.

Organic arsenic oxides and arsenobenzenes. A. ALBERT. Can. 251,038, June 30, 1925. New org. As compds. contg. trivalent As and H groups are prepd. by treating hydrazones of mixed aliphatic-aromatic keto-arsenic acids with reducing agents.

Derivatives of organic arsenic compounds. A. ALBERT. *Can.* 251,037, June 30, 1925. Mixed aliphatic aromatic arsenic acids are treated with substances which have a hydrazine nature to produce new derivs.

11—BIOLOGICAL CHEMISTRY

PAUL E. HOWE

A—GENERAL

FRANK P. UNDERHILL

Experimental study on the favoring action of carbohydrates on the oxidation of acetoacetic acid. Z. ERNST AND G. FÖRSTER. *Wiener Arch inn Med* 10, 351-6 (1925).—The favoring of the oxidation of $\text{AcCH}_2\text{CO}_2\text{H}$ by H_2O_2 is brought about not only by glucose, but by other monosaccharides, mannitol, glycerol and glyceryl butyrate. Mono- and dihydric alcs., aldehydes and ketones, di- and polysaccharides, and various org. acids do not favor the oxidation. HARMET F. HOLMES

The effect of light on the permeability of lecithin. L. B. BECKING AND M. I. GREGERSEN. *Proc. Soc. Exptl. Biol. Med.* 22, 139-3 (1924).—Lecithin collodion membranes were prepd. by pouring a 5% soln. of lecithin and 5% of collodion in ether over glass plates. The rate of diffusion of KCl through the membrane was detd. by the change in elec. cond. of distd. H_2O by the electrolyte. Exposure to light for 5 min. caused an increase in elec. cond. followed by a decrease. The membranes lost their sensitivity to light after 6 or 7 days. C. V. B.

The effect of light and of darkness on some urinary and blood constituents in the dog. H. LAURENS, H. S. MAYERSON AND L. GUNTHER. *Proc. Soc. Exptl. Biol. Med.* 22, 171-4 (1924).—Dogs kept under ideal lab. conditions evidenced considerable excitement for the first few days of darkness lasting 36 days, and again when light was readmitted. These periods of excitement were accompanied by increases in urinary and blood non-protein N, an increase of blood sugar and of chloride excretion. C. V. B.

Histochemical proof of the presence of protein matter in dental enamel. C. F. BÖDECKER AND W. J. GIES. *Proc. Soc. Exptl. Biol. Med.* 22, 175-6 (1924).—Enamel residue, obtained by decalcifying by the Bodecker process, was tested under the microscope with Gies reagent for Protrowsky's biuret test. The results were positive for protein and negative for carbohydrate and aldehydes which would give the reaction. The residue, when gently warmed with Millon reagent, gave the protein reaction. C. V. B.

Photodynamic phenomena. III. Fixation of active dyes in the cell. P. METZNER. *Biochem. Z.* 148, 498-523 (1924); cf. *C. A.* 15, 1537.—Photodynamically active dyes show in general negative phototaxis. Cresyl fast violet exhibits induced photokinesis. In the cell, the active portion of the dye is adsorbed and shows absorption and fluorescent spectra which differ from those of the substance when in soln., being displaced towards the red. It is suggested that the active adsorbent is a phosphatide or a tyrosine compd. The activity spectra and absorption spectra are approx. proportional without showing exact correspondence, and the former is also displaced towards the red in the adsorbed dye. Conclusion: Photodynamic dyes become active only within the cell. B. C. A.

Tryptic digestion with dilute enzyme solutions. R. EHRENBERG. *Biochem. Z.* 149, 269-93 (1924).—From a lengthy series of observations on the proteolytic action of trypsin in very dil. soln. on casein, egg albumin and gelatin, support is gained for the view that the enzyme undergoes a change in the course of its action, whereby its activity is lowered, by an association formed with inhibitory substances liberated or built up during the hydrolysis (cf. *C. A.* 16, 1963). B. C. A.

Auxo-ureases. T. HOSOKAWA. *Biochem. Z.* 149, 363-73 (1924).—By pptn. of urease preps. with cholesterol, a fractional sepn. of urease from its naturally occurring auxo-substances is achieved. The inactive enzyme so obtained is reactivated by the addn. of auxo-substances. Fibrin may act as one of the latter, since practically in active urease shows a marked increase in activity when adsorbed on this protein. Ca and Sr chlorides also increase the activity of urease, but not so markedly as does KCN, while BaCl_2 is practically devoid of such action. Na citrate, oxalate and fluoride similarly act as auxo-ureases, while K and Na chlorides have little action. The action of MgCl_2 is antagonistic to that of SrCl_2 and under proper conditions NaCl shows a similar antagonism to Sr. The activity of the enzyme is enhanced if the activating salts are kept in contact with urea for 10 min. before the urease is added. B. C. A.

The electric phenomenon and ion permeability of membranes. I. Potential difference in the apple peel. A. FUJITA. *Biochem. Z.* **158**, 11-27(1925).—The p. d. of apple skin against aq. electrolyte solns. shows an increasing potential of the cations, according to the series: H, Rb, K, Na, Li, Ca, Ba, Mg, Al, when present in the same concns. Only slight differences of potential were found between various anions, at the same concns. Concns. effects on the p. d. were greater with univalent cations, smaller with cations of higher valence and insignificant with anions. Apple skin retains these characteristics after treatment with ether, CH_2O , HgCl_2 and is only slightly diminished by boiling. **II. Permeability of apple peel.** I. MICHAELIS AND A. FUJITA. *Ibid.* 28-37.—When an apple with an intact skin was left in pure H_2O 2 weeks, no K passed from the apple to the H_2O . When the apple was left in NaCl soln., a slow exchange of Na and K between apple and soln. was found. No evidence of exchange of anions was found; the apple skin is a membrane permeable for cations but not for anions. F. A. CAYORI

Autolysis. III. The characteristics of the autolytic process in liver pulp. O. STEPPUHN AND X. UTKIN-LIUBOVZOV. *Biochem. Z.* **158**, 38-49(1925); cf. *C. A.* **19**, 527.—The rate of hydrolysis of casein when added to liver pulp at pH 3.8 decreases regularly. At pH 7.0, the hydrolysis rate decreases more rapidly but a phase of very rapid proteolysis is observed. This is due to the destruction of antitrypsin. F. A. C.

Extra-vascular changes in the reaction of human blood. G. HOLLO AND ISTVAN WEISS. *Biochem. Z.* **158**, 211-7(1925).—Blood, after its removal from the body and in a closed container, becomes gradually acid on account of (1) glucolysis which may be checked by NaF and (2) bacterial contamination. Blood may become alk. on standing because of reduction of oxy-hemoglobin by putrefactive changes. F. A. CAYORI

Ethylene peroxides. The oxygenase of the Chodat-Bach system. ODDULIO FERNÁNDEZ. *Bull. soc. chim.* **37**, 1085-8(1925).—See *C. A.* **19**, 2348. E. J. C.

The role of γ -glucose in carbohydrate metabolism. W. WINDISCH. *Wochschr. Brau.* **42**, 99-102(1925).—The relation of structure to biol. activity is discussed. C. N. FREY

The chemistry of carbohydrate metabolism during alcoholic fermentation. W. WINDISCH. *Wochschr. Brau.* **42**, 113-4(1925).—The theories of Harden and Young, Neuberg, Gottschalk, Euler, Abderhalden, Frankel and Schwarz and Haehn are discussed. C. N. FREY

Investigations on diastase. W. WINDISCH. *Wochschr. Brau.* **42**, 136-8(1925).—The nature and action of diastase are discussed. C. N. FREY

The mechanism of the action of amylase. W. WINDISCH. *Wochschr. Brau.* **42**, 148-50, 153-6, 159, 166-7, 171-3(1925).—The nature of amylases, hexosans and the action of polymerization and association are discussed. Expts. relative to optimum pH , and the distinction between various enzymes and hydrolyzates are reported. The effect of the enzyme on the starch mol. is postulated. C. N. FREY

The relation of the products of metabolism to cell respiration. W. WINDISCH. *Wochschr. Brau.* **42**, 177-8, 183-4(1925).—The newer theories of cell oxidation are discussed. C. N. FREY

The action of diastase on starch. M. ECKHARD. *Z. Spirituind.* **48**, 249(1925).—Expts. indicate that at 50-55° optimum conversion of starch to maltose by means of diastase takes place. More than 80% maltose and less than 20% dextrin cannot be obtained. C. N. FREY

Studies on glycogen. I. The nature of yeast glycogen, its preparation, estimation, and role in yeast metabolism. A. R. LING, D. R. NANJI AND F. J. RATON. *J. Inst. Brewing* **31**, 316-21(1925); *Analyst* **50**, 407.—The method used for prep. glycogen consists essentially in extn. of dried yeast with boiling 2% NaOH soln., pptn. with alc., and removal of the mannan extd. with the glycogen by addn. of Fehling soln. to the aq. soln. of the mixt. In estg. the glycogen and mannan in yeast during various stages of fermentation, the yeast was skimmed off, filtered and washed with water on a Buchner funnel, and 50 g. of the yeast of known moisture content heated with 110 cc. of 85% KOH soln. for 2 hrs. on a water bath. The cold liquid was made up to 500 cc., and filtered, and each of two 100 cc. portions of the filtrate pptd. by addn. of alc. to bring the concn. of the latter in the liquid to 55%. The ppts. were allowed to settle overnight and were then washed with 60% and afterwards with 95% alc., dissolved in hot water and neutralized. One of the solns. was treated with sufficient H_2SO_4 to make the final concn. of the acid 8%. The second portion was treated in warm 2% NaOH soln. with Fehling soln., and the pptd. mannan allowed to settle; the clear supernatant liquid was decanted and the ppt. transferred to a small filter paper, washed with 2% NaOH soln., the mannan compd. on the filter being dissolved

in cold 8% H_2SO_4 , and the filter paper washed with similar acid. The 2 solns. were then heated for 3 hrs. under a reflux condenser, cooled, neutralized carefully with NaOH , made up to 200 cc., and the soln. contg. mannan filtered through a fine filter paper from the pptd. Cu hydroxide. The dextrose and mannose were then detd. iodimetrically in aliquot parts of the 2 solns. H. G.

Studies in calcification. I. The solubility product of secondary and tertiary calcium phosphate under various conditions. L. EMMETT HOYT, JR., V. K. LA MER AND H. BRUCE CHOWN. *J. Biol. Chem.* **64**, 509-65 (1925).—"A method is described for evaluating the soly. product const. of CaHPO_4 from the titration data of H_3PO_4 with $\text{Ca}(\text{OH})_2$ (and the ionization const. of H_3PO_4). The p_{H} ranges at which CaHPO_4 and $\text{Ca}_3(\text{PO}_4)_2$ are stable have been established. (CaHPO_4 is pptd. at p_{H} 5.0; increasing amts of $\text{Ca}(\text{OH})_2$ change the ppt. to $\text{Ca}_3(\text{PO}_4)_2$ without appreciable change in p_{H} until there is a sharp change with formation of a more basic ppt. at p_{H} 6.0. Abstr.) The soly. product in terms of activities (*i. e.*, the stoichiometric soly. product at infinite diln.) is found to be $10^{-6.4}$ for CaHPO_4 and $10^{-82.5}$ for $\text{Ca}_3(\text{PO}_4)_2$ at 38° . When expressed in stoichiometric units, it is found that these soly. product const. are enormously affected by the presence of other salts. These variations are found to be in agreement with the theory of soly. in salt solns., as developed by Brönsted and by Debye and Hückel. The stoichiometric soly. product const. for $\text{Ca}_3(\text{PO}_4)_2$ in blood serum is found to be 10^{-26} ; in a soln. contg. the inorg. salts of blood serum the value is about $10^{-27.2}$ at 38° . At the reaction at which $\text{Ca}_3(\text{PO}_4)_2$ is being pptd., the addn. of $\text{Ca}(\text{OH})_2$ to a phosphate soln. leads to a decrease in the Ca-ion concn. If the definition of Kugelmass (*C. A.* **18**, 2722) for the Ca buffer value is used, a discontinuous curve is obtained. H., L. and C. prefer to define as $d \text{ Ca}^{++}/d \text{ Ca}(\text{OH})_2$. This gives a continuous curve. The greater the soly. of $\text{Ca}_3(\text{PO}_4)_2$, due to the presence of other salts, the greater the p_{H} at which the buffer value is shown. **II. Delayed equilibrium between the calcium phosphates and its biological significance.** *Ibid* 567-78. "The pptn. of $\text{Ca}_3(\text{PO}_4)_2$ (when $\text{Ca}(\text{OH})_2$ is added to H_3PO_4 solns.) occurs so slowly that solns. may remain supersatd. for many days. . . . The delay in final equil. is produced by 2 factors: (1) the transitory formation of CaHPO_4 and (2) the inherent slowness of the pptn. of $\text{Ca}_3(\text{PO}_4)_2$, which is perhaps due to the fact that this is a reaction of the 5th order. . . . When fresh sterile blood serum is shaken at 38° in the absence of solid $\text{Ca}_3(\text{PO}_4)_2$ little or no reduction in the ion product occurs (no expl. data are given. Abstr.), but when the shaking is carried out in contact with this salt, a marked reduction occurs, quite analogous to that found with inorg. solns." The Ca content falls to 1.5 or 2 mg. per 100 cc. serum. The high Ca content of normal serum is believed to be due to delayed pptn. of Ca absorbed from the more acid intestines into the more alk. blood. The maintained normal Ca content of the blood when little or no Ca is being ingested, and much is being eliminated, is not considered. I. G.

The probable dimensions of the molecule and molecular weight of crystalline egg albumin. P. LECOMTE DU NOUY. *J. Biol. Chem.* **64**, 595-613 (1925).—"The tensiometric method of the minima of static surface tension was applied to cryst. egg albumin and revealed the existence of numerous minima at dilns. between 1/70,000 and 1/250,000. From the 2 principal minima occurring most frequently, the dimensions of the 'phantom shape' of the mol. are calcd. They are 41.7×10^{-8} cm. and 30.8×10^{-8} cm. Assuming the 'phantom shape' to be a parallelopiped, and the sp. gr., a property of all the space occupied by it, it yields for the upper limit of the mol. wt. 30,800. If mean values are taken into account, one obtains 30,000. . . . Assuming that the shape is not that of a parallelopiped, and that it may be a prism with a polygonal base, the lowest limit is given by considering it as a cylinder, the height of which is 42 A. U., and the diam. 30.3 units. It is then found to be 23,550. This hypothesis seems little probable. . . . The first figure appears to be more correct, as it corresponds almost exactly to twice the value derived from the knowledge of the S content. This would seem to indicate that the mols. do not interpenetrate each other and that, when packed up in a similarly oriented way, they behave as though they occupied a 'phantom space' in the shape of a parallelopiped with a square base. This view seems to receive some support from the fact that the mean space occupied by 1 C atom in a series of 8 org. compds. is very nearly the same as that which it would occupy in the above-described mol., namely, 28.45×10^{-24} cc. Consequently, it is probable that the dimensions of the space occupied by 1 mol. of cryst. egg albumin are $30.8 \times 30.8 \times 41.7$ A. U." I. GREENWALD

The effect of p_{H} on the oxygen consumption of tissues. A. E. KOEHLER AND R. J. REITZEL. *J. Biol. Chem.* **64**, 739-51 (1925).—"The rate of O_2 consumption, by suspensions of minced rabbit liver, heart muscle or skeletal muscle is a function of the

H-ion concn. The optimum was at p_H 7.4 to 7.5. At $p_H < 4.8$ or > 10 , O_2 consumption was almost completely abolished. Human blood gave similar results. At optimum p_H , heart muscle was most active, liver much less and skeletal muscle still less. Cf. *C. A.* 19, 2217.

I. GREENWALD

Studies on glucolysis in vitro. SERGIUS MORGULIS AND O. BARKUS. *J. Biol. Chem.* 65, 1-5(1925).—Oxalated and defibrinated sheep and dog bloods were allowed to stand under aseptic conditions. Glucolysis occurred and was accompanied by an increase in the concn. of lactic acid but not of inorg. P unless hemolysis occurred.

I. GREENWALD

The nitrogen distribution and percentages of some amino acids in the muscle of the shrimp, *Peneus setiferus* (L.). D. BREESE JONES, OTTO MOELLER AND CHARLES E. T. GERSDORFF. *J. Biol. Chem.* 65, 59-66(1925).—After extn. with 95% EtOH and with H_2O at room temp., the finely ground muscle of the shrimp, *Peneus setiferus* (L.), yielded a white, tasteless and odorless powder, having the compn., calcd. to ash- and H_2O -free basis, C 52.93%, H 6.33%, N 16.88%, S 1.55%. Analysis by the Van Slyke method gave the following distribution of N: amide 8.13%; humin 1.29%; cystine 1.21%; arginine 19.52%; histidine 3.78%; lysine 8.63%; aminic N of filtrate 50.38%, non-amino N in filtrate 4.53%. Colorimetric methods (*C. A.* 16, 1790; 19, 2062) showed the presence of 1.78% cystine, 1.21% tryptophan and 88% tyrosine. Gravimetric detns. showed the presence of 6.98% aspartic acid and 15.0% glutamic acid. I. G.

Blood sugar time curves following the ingestion of dihydroxyacetone. I. M. RABINOWITZ. *J. Biol. Chem.* 65, 55-8(1925).—"When dihydroxyacetone was given to any subject (normal or diabetic) in a quantity not greater than that corresponding to the detd. rate of utilization of carbohydrates in that individual (detd. by respiratory quotient and total metabolism studies), there was only a slight initial increment or none at all. This was followed by a fall in the blood sugar below the level noted prior to admission." (Cf. *C. A.* 19, 898.)

I. GREENWALD

Temperature coefficients of enzymic activity and the heat destruction of pancreatic and malt amylases. D. H. COOK. *J. Biol. Chem.* 65, 135-46(1925).—"The rates of starch hydrolysis by pancreatic and malt amylases used in the forms of good grades of com. pancreatin and malt have been detd. under certain specified conditions for the temp. range of 20° to 70°. At temps. below the point where destruction of the enzyme plays an important role, the rate of hydrolysis is about doubled for every 10° rise in temp. The temp. and rate of destruction of these enzymes in H_2O -NaCl solns. have been detd. and malt amylase is found to be much more stable than pancreatic amylase, the latter being completely destroyed in 15 min. heating at 50°, while malt amylase still shows a trace of activity after 30 min. at 60°; pancreatic amylase is apparently inactivated 30 times as fast at 50° as is malt amylase. The results. . . . show a wide divergence from those giving the rates of destruction of vitamins B and C (*C. A.* 16, 1605; 18, 1691) and make it appear doubtful that any advantage is to be gained by classing vitamins as enzymes as has sometimes been suggested. The results support the view that the heat destruction of the enzyme may be a process of the nature of the coagulation of a protein, probably accompanied by partial hydrolysis also."

I. GREENWALD

Sulfur in proteins. II. The effect of mild alkaline hydrolysis upon hair. W. F. HOFFMAN. *J. Biol. Chem.* 65, 251-4(1925); cf. *C. A.* 16, 1565.—"Hair, which has been heated with 1% Na_2CO_3 for even a short time cannot be used as a source of cystine. Even though only about 25% of the total S has been removed, a change has been brought about, presumably in the cystine mol., that prevents the formation of cystine crystals during the regular method of cystine prepn." (H. seems not to have tested the acid hydrolysate with the reagent of Folin and Looney. Abstr.)

I. GREENWALD

Colloid-chemical investigations concerning cholesterol. RUDOLF STERN. *Klin. Wochschr.* 4, 1650-1(1925).—A stable, cholesterol sol was prepd. (method not described). When treated with acid buffer solns., flocculation occurs at p_H 5.0. This sol is pptd. by small quantities of an electrolyte-free serum albumin. The pptn. is not due to an elec. discharge of the cholesterol sol (cataphoresis expt.); hence it must be a dehydration phenomenon.

MILTON HANKE

Solubility of proteins and proteoses in aldehydes and other organic solvents. E. A. COOPER AND S. D. NICHOLAS. *Biochem. J.* 19, 533-7(1925).—The soly. of proteins, proteoses and lipins in org. solvents such as aldehydes, phenols and amines is influenced by the chem. structure of the solvent and by the temp.

B. H.

Glucose content of normal urine. G. S. LUND AND C. G. L. WOLF. *Biochem. J.* 19, 538-40(1925).—With the aid of Barcroft's differential manometer (Barcroft, Respiratory Function of the Blood, p. 291 (Cambridge, 1914; cf. *C. A.* 8, 1969)), the

authors show that no CO_2 is formed when normal urine is treated with yeast. This points to the absence of glucose from normal urine. BENJAMIN HARROW

Iron, the oxygen transporting constituent of the respiration enzyme. OTTO WARBURG. *Ber.* 58B, 1001-11(1925); cf. *C. A.* 18, 277, 845; 19, 430, 527, 1711, 2506.—A summary of the facts established in previous publications. In the meantime it was found by the method of W. and Sakuma (*C. A.* 18, 845), that the oxidation of $\text{C}_2\text{H}_2\text{O}_4$ by HIO_3 is also catalyzed by traces of Fe. The instability of the HCN-Fe combination was proved for the same system by the fact that the normal oxidation velocity was reestablished by passing an air current through the poisoned soln. MARY JACOBSEN

Anomalous crystals and their relation to oxalate sediments and erythrocytes. BRUNO BARDACH. *Chem.-Ztg.* 49, 662(1925); cf. *C. A.* 5, 3692.— CaC_2O_4 in urine sediments presents, besides the normal envelope form, egg-, dumb-bell-, spherical-, disk- or ring-shaped crystals. As with CHI_3 and uric acid the cryst. form is affected by the reaction of the medium and the concn. and nature of the other solutes and often affords conclusions regarding the latter. The influence of the solutes is partly mech. (inclusions), and partly exerted through the medium of surface tension and capillary attraction. The spherical crystals resemble CaCO_3 aggregates and suggest inclusions of the latter. The ring-shaped structures often resemble erythrocyte "ghosts" and may cause diagnostic errors. MARY JACOBSEN

The putrefaction of agmatine. H. REINWEIN AND K. L. KOCHINKI. *Z. Biol.* 81, 281-5(1924).—Putrefaction was allowed to proceed in a medium contg. agmatine plus Witte peptone, dextrose, Na phosphate and MgSO_4 . Putrescine was isolated from the mixt. as the Au salt, $\text{C}_4\text{H}_{12}\text{N}_2 \cdot 2\text{HAuCl}_4$. FRANCES KRASNOW

Biochemical transformation of unsymmetrical dichloroacetone into optically active α, α -dichloroisopropyl alcohol. H. K. SEN. *Biochem. Z.* 151, 51-3(1924).—An alc. soln. of α, α -dichloroacetone was slowly added to growing yeast. After 2 or 3 days the odor of dichloroacetone had disappeared. The residue was filtered and distd. *in vacuo*, the distillate extd. with ether, and the ether distd. off. The residue contained sym-dichloroisopropyl alc. (α)_D = -8.62° . W. D. LANGLEY

Dependence of the stimulation of the respiratory center upon the equilibrium between certain ions in the blood. KLOTHILDE GOLLWITZER-MEIER. *Biochem. Z.* 151, 54-83(1924).—Rabbits were anesthetized lightly with urethan, packed in a cast to act as a plethysmograph and cannulas placed in the carotid artery and jugular vein. CO_2 was detd. in blood, and the C_H was detd. from free and bound CO_2 . Salts such as MgCl_2 , CaCl_2 , KCl , NaCl and Na_2HPO_4 were injected. Stimulation of the respiratory center is found to vary with the size of the quotient $[\text{HPO}_4^{--} + \text{H}_2\text{PO}_4^-] / [\text{K}^+] / [\text{Ca}^{++}] [\text{Mg}^{++}]$. The apparent influence of Ca is due really to an alk. reaction of blood. Phosphate probably acts only indirectly by influencing Ca dissociation. W. D. LANGLEY

Influence of hydrogen-ion concentration on the salt flocculation of serum proteins. I. J. CSAPO AND D. V. KLOBUSITZKY. *Biochem. Z.* 151, 90-7(1924).—At different C_H there is no change of the serum albumin to serum globulin, but the pptg. strengths of Na_2SO_4 and NaCl change. The flocculation value of the salts is least between p_H 7.4 and the isoelec. point. W. D. LANGLEY

Investigation of diastatic disintegration of starch. L. DE HOOP AND J. A. VAN LAER. *Biochem. Z.* 155, 235-44(1925); cf. *C. A.* 17, 2704.—Starch may be 96% hydrolyzed to maltose by diastase, provided that sufficient coenzyme is present. If this coenzyme is present in too small a quantity the reaction may stop when the mixt. consists of 80% maltose and 20% dextrin. The maltose is sep'd. from the dextrin by means of the insoly. of the dextrin in a pyridine-alc. mixt. W. D. LANGLEY

The influence of lecithin, cholesterol, and cholesterol derivatives upon tryptic digestion. FR. STANDENATH. *Biochem. Z.* 155, 245-6(1925).—Lecithin slows up hydrolysis of casein by trypsin, but cholesterol and its derivs., e. g., propionate, oleate, bromide, dibromide, chloride, dichloride and acetate as well as nitrocholesterol acetate, and cholic acid all failed to affect the rate of hydrolysis. W. D. LANGLEY

The primary effect of radium rays on living material. G. A. NADSON. *Biochem. Z.* 155, 381-6(1925).—The changes visible in a yeast cell during irradiation with radium rays are sketched and explained. W. D. LANGLEY

Isolation of peroxidase (Schardinger's enzyme) of milk. B. SBATSKY AND D. MICHLIN. *Biochem. Z.* 155, 485-94(1925).—Buttermilk contains a relatively high concn. of Schardinger's enzyme, but addn. of alc., sulfates and phosphotungstic acid failed to ppt. it. Me_2CO , however, did ppt. the enzyme. The ppt. was washed and extd. with petroleum ether. The residue is 240 times more active than milk. Treatment of this residue with dil. HCl dissolved the enzyme and a prepn. 480 times stronger

than milk was obtained. It acted upon methylene blue in the presence of aldehyde, protein hydrolytic products, xanthine and hypoxanthine. Therefore, Schardinger's enzyme is identical with purine oxidase and perhydridase. W. D. JANGLEY

* **Artificial and natural phosphorylation of sugars.** C. NEUBERG AND M. KOBEL. *Biochem. Z.* 155, 499-506(1925).—Because of the presence of O, CO₂ was evolved from fructose in Na₂HPO₄ soln. with added CuSO₄ at $p_H = 8.4$. *No phosphoric acid ester was formed. The same was true with glucose. But dry yeast, in the presence of KCN, did cause the formation of phosphoric ester with glucose. Slight phosphorylation occurred with yeast ext. and KCN, and with the coenzyme from yeast, it increased markedly for 4 hrs. but again decreased. With added NaHCO₃, the inorg. phosphates disappeared entirely, showing complete phosphorylation of the hexose. W. D. L.

Biochemistry of the fats. W. R. BLOOR. *Chem. Rev.* 2, 243-300(1925).—Extended review of fats, including also a discussion of the lipoids related to fats, in the organism with full bibliography. H. B. LEWIS

Polysaccharides. XXXI. The splitting of structural tissue (gerüst) cellulose by enzymes. P. KARRER AND H. ILLING. *Kolloid-Z. Special No.*, Apr. 1, 1925, 91-5; cf. C. A. 19, 1853.—No enzyme is known that is capable of more than a mere trace of action upon cotton in its native state. 3.1 g. of cotton cellulose pptd. out of a CrO₃-NH₃ soln. and dried in vacuum over P₂O₅ at 90° was treated for 4 days at 36° with 150 cc. of dialyzed, sugar-free enzyme soln. obtained from the gastrointestinal canal of 11 snails. After a 3rd treatment of the residue 96% of the cellulose was changed to glucose. A somewhat stronger soln. of the enzyme practically completed the change to sugar with only one treatment. The optimum p_H for the action of the enzyme was 5.28. Viscose silk and cellulose pptd. out of thiocyanate solns. were also changed quant. to sugar by the action of cellulase from the ext. of pancreas. H. M. M.

Polysaccharides. XXXII. The kinetics of the enzymic degradation of cellulose. P. KARRER AND H. ILLING. *Helvetica Chim. Acta* 8, 245-7(1925); cf. preceding abstract.—Cellulose, repptd. from cuprammonium soln. and dried, is attacked by a soln. of the enzyme of *Helix pomatia* (from the hepato-pancreatic fluid), the yield of glucose being as high as 38%. Doubling the amt. of enzyme increases the splitting in a given time by 45-65%; other rate data are given, the reaction being shown to be approx. mono-mol. **XXXIII. Lichtotriose, a new sugar from lichenin.** P. KARRER AND H. LIER. *Ibid* 248-9.—If an enzyme soln. from snails, contg. mainly cellobiase, be repeatedly shaken with Al(OH)₃, the cellobiase is almost completely removed, although enzymes remain which attack lichenin strongly. Some glucose is formed by this latter enzyme, as well as the new sugar *lichtotriose* (I) and some uncharacterized substances. The *osazone* of I is sol. in hot H₂O but difficultly sol. in cold, the sepn. of I from glucose hence being easy. The osazone, after 7 recrystns. from H₂O, m. 78°, $\alpha_D = -46.47^\circ$ (in alc.), its analysis corresponding to that of a trisaccharide deriv. WM. B. PLUMMER

Effect of insulin on the permeability of sugar through celloidion sacs. C. E. PICO AND J. NEGRET. *Compt. rend. soc. biol.* 92, 905-7(1925).—In the presence of insulin a greater concn. of glucose is obtained in the dialyzate than without the insulin; P also increases the permeability still further, though by itself it has no effect on the rate of dialysis. S. MORGULIS

The in vitro effect of ultra-violet rays on carbon-monoxide hemoglobin. HENRI BENARD AND E. AND H. BIANCANI. *Compt. rend. soc. Mol.* 92, 1031-3(1925).—CO-hemoglobin exposed to a Hg-vapor lamp of 1500 candle power at a distance of 15 cm. disappears in from 30 to 60 min. This is ascribed to the reaction found by Berthelot that under the influence of radiation $CO_2 \rightleftharpoons 2 CO + O_2$. S. MORGULIS

Is the poison contained in aqueous extracts of tentacles and nematocysts of *Adamsia palliata* destroyed by heat? Studies on adsorption. N. L. COSMOVICI. *Compt. rend. soc. biol.* 92, 1373-4(1925).—Boiling for 5 min. does not apparently destroy the toxic element of the aqueous ext. of *Adamsia*. When the ext. is thoroughly mixed with a measured quantity of ground crab muscle, nerve or eggs and the mixt. is filtered after 2 hrs. a comparison of its toxicity with that of the original ext. shows that the power of adsorbing the toxin is in the order nerve < muscle < eggs and is not apparently related to the lipid content. Also the tissues of the crab have a specific affinity for the toxin, as those of the fish are without adsorbing ability. S. M.

The relation between refractive index, viscosity and the albumin content of blood serum. CHALIER, BOULUD AND CHEVALLIER. *Compt. rend. soc. biol.* 93, 173-5(1925). S. MORGULIS

Methemoglobin contains more oxygen than oxyhemoglobin. V. BALTHAZARD AND M. PHILIPPE. *Compt. rend. soc. biol.* 93, 398-400(1925).—Contrary to Nicloux and Roche who regard methemoglobin as a HbO compd., B. and P. consider methemo-

globin as a peroxide of hemoglobin, HbO_2 . They show that when this is subjected to very mild reduction and in the complete absence of O_2 the typical HbO_2 (oxyhemoglobin) spectrum appears. S. MORGULIS

Effect of electrolysis on diastatic activity. F. MAIGNON. *Compt. rend. soc. biol.* 93, 400-3(1925); cf. C. A. 18, 1304.—Prolonged electrolysis of a pancreatic diastase soln. causes complete loss of its activity. This is not due to the formation of peracids which inhibit the reaction but is apparently connected with an electrolytic dissociation of the organic mineral constituents of the diastase. S. MORGULIS

Effect of albumin-globulin ratio on the osmotic pressure of serum proteins. PAUL GOVAERTS. *Compt. rend. soc. biol.* 93, 441-3(1925).—The osmotic pressure of serum per g. of protein varies directly with the albumin-globulin ratio. This is easy to understand since 1 g. of albumin has an osmotic pressure of 7.54 cc. H_2O and 1 g. globulin per 1.95 cc. Knowing the percent of protein and the albumin-globulin ratio of a serum permits the calcn. of its osmotic pressure with much accuracy. Changes in the albumin-globulin ratio so frequent in pathological states are, therefore, of great importance, since this is one of the primary factors in regulating the mass of blood and the exchange of fluid between the capillaries and the interstitial spaces. S. MORGULIS

Glucose and the colloidal equilibrium of lipids. M. NECHKOVITCH. *Compt. rend. soc. biol.* 93, 651-2(1925).—Glucose offers slight protection to a soln. of lecithin against agents which tend to opt the micellae. Glucose also protects the red blood cells against hemolytic agents which attack the proteins of their surface layer. CHCl_3 hemolysis is due to its action on the lipoids, but alc., chloral and HCl hemolysis is caused by their action upon the proteins of the surface layer. Also in *Arch. intern. physiol.* 24, 1-12(1924). S. MORGULIS

Studies of cellular permeability. LÉON BLUM, M. DELAVILLE AND C. M. JONES. *Compt. rend. soc. biol.* 93, 704-6(1925).—A comparative study of the PO_4 , Ca, Na and acic acid distribution between the red cells and plasma of untreated blood and of blood through which CO_2 has been bubbled shows that in the latter case the acid elements enter the cells while the basic substances present within the cell pass into the plasma. S. M.

Behavior of α - and β -glucose towards yeast and Taka-diastase. YAJIRO HATTORI. *J. Biochem. (Japan)* 5, 39-47(1925); cf. C. A. 19, 527.—Pure glucose without water of crystn., and crystd. from abs. alc., is used. 100 g. of this glucose is dissolved in 10 cc. of water on the water bath, then over an open flame, until a sirup is formed. β -Glucose is prepd. in the following way: To the sirup is added 120 cc. of glacial AcOH heated to 100° and also a small piece of β -glucose, and the whole well mixed. The β -glucose crystallizes out and is then recrystd. twice. This is done by dissolving 100 g. of the β -glucose in 100 cc. H_2O cooled to 0° and quickly filtered. Pure cryst. β -glucose is obtained from this by adding 500 cc. abs. alc. and a piece of β -glucose to the mixt. The α -glucose is likewise prepd. from a sirup made by dissolving 100 g. glucose in 50 cc. H_2O on a water bath and adding to this 200 cc. AcOH . The slowly crystallizable α -glucose is sepd. and washed with 95% alc., then with abs. alc. The 2 preps. have the theoretical sp. rotating power $[\alpha]_D = +100^\circ$ for the α - and $+19.8^\circ$ for the β -glucose. The α -glucose has no inhibitory effect on yeast invertase while the β -glucose does inhibit strongly the hydrolysis of the sucrose, the inhibition depending upon the concn. of the β -glucose and not of the sucrose. In the case of Taka-invertase the situation is reversed and the α -glucose alone causes strong inhibition, the degree of the inhibition depending, however, on the sucrose concn. and not on the concn. of the α -glucose. The kinetics of the inversion of sucrose cannot be represented by the simple formula suggested by Michaelis. S. MORGULIS

Snake skin. SHU QIKAWA. *J. Biochem. (Japan)* 5, 57-62(1925).—The shedding of the skins in snakes (python) is caused by an accumulation of wax-like lipoids between the dead, dry horny layer and the live layer of the skin. This horny layer is similar in compn. to that of other higher organisms. The keratin of the shed skin of python has the following compn.: 14.65 % total N, 0.26 humin N, 12.34 monoamino acid N, 0.14 cystine N, 0.08 arginine N, 1.35% ammonia N. The various amino acids were present in these proportions: alanine 2, valine 2, leucine 2, isoleucine 0.3, phenylalanine 2, tyrosine 6, glutamic acid 0.2%. No glycocoll was found in the keratin. S. MORGULIS

Hemin crystals prepared from camel blood. B. E. READ. *J. Biochem. (Japan)* 5, 99-102(1925).—Hemin crystals obtained from camel blood show striking peculiarities which sharply distinguish them from those obtained from other bloods, especially human blood. The difference in the general blood chemistry of the species may be responsible for these crystal differences. S. MORGULIS

The theory of vision. P. LAZAREV. *Naturwissenschaften* 13, 659-60(1925).—

L. claims that his theory (*C. A.* 8, 1288; 19, 995) and the one of Pütter (*C. A.* 13, 2042), both assuming a monomol. dark reaction for the restoration of the retinal purple, represent the exptl. data as well as the recent alteration by Hecht (*C. A.* 19, 1144), who makes it a bimol. reaction. Reply. SELIG HECHT. *Ibid* 660-1. B. J. C. VAN DER HOEVEN

Amylase in the spores of *Rhizopus tritici* and *Rhizopus nigricans*. L. L. HARTER AND J. L. WEIMER. *Am. J. Bot.* 10, 89-92(1925).—An enzyme is produced in the spores of *R. tritici* and *R. nigricans* capable of hydrolyzing Irish potato starch paste to reducing sugars. The enzyme is produced at temps. at which spores are produced. J. J. S.

Effect of Röntgen rays on proteins. II. PAUL WELS AND ADOLF CHIELE. *Arch. ges. Physiol.* (Pflüger's) 209, 49-64(1925); cf. *C. A.* 17, 3516.—By means of an ultra-microscopic method which permits a quant. study of the state of soln., the effects of Röntgen rays upon proteins were detd., the results indicating that with irradiation with doses far below the max. therapeutic dose an aggregate formation in globulin solns takes place. This aggregate formation occurs on both the acid and the alk. sides of the isoelec. point and is therefore quite independent of the elec. charge which the particles bear. Agencies which alter the soly. state of the protein also change the effect of the irradiation. G. H. S.

The imitation of the smallest details of the *Microsporidia* with calcium fluosilicate. A. L. HERRERA. *Atti accad. Lincei* [6], 1, 639-43(1925); cf. *C. A.* 19, 992, 2058.

E. J. WITZEMANN

Sensitivity and protective action through lipoids (BECK) 2.

MCCLENDON, JESSE FRANCIS and MEDES, GRACE: **Physical Chemistry in Biology and Medicine.** Philadelphia and London: W. B. Saunders Co. 425 pp.

B—METHODS AND APPARATUS

STANLEY R. BENEDICT

The extraction of alkaloids from blood. R. A. HATCHER. *Proc. Soc. Exptl. Biol. Med.* 22, 141-2(1924).—Alkaloidal salts can be extd. from defibrinated cat blood, urine or bile by shaking with CHCl_3 . Strychnine was recovered from a million parts of blood. The method is applicable to codeine, heroin, quinine and nearly all of the common vegetable alkaloids. C. V. B.

The determination of the iodine number of coprosterol. H. DAM. *Biochem. Z.* 158, 76-80(1925).—An I no. of 10 was found for coprosterol by either the Hanus or pyridine sulfate dibromide method. Winkler's method gave higher values. Since with the pyridine method cholesterol gives an I no. of 65, an empirical calcn. of the coprosterol content of coprosterol-cholesterol mixts. can be made from a detn. of the I no. of such mixts. F. A. CAJORI

A simple micro-method for the determination of blood sugar. L. LORBER. *Biochem. Z.* 158, 205-10(1925).—To 0.3 cc. blood, dild. to 2 cc. with H_2O , add 0.5 cc. each of 10% NaWO_4 and $\frac{2}{3}$ $\text{N H}_2\text{SO}_4$. Make up 1.5 cc. of the filtrate and 1 cc. of a Cu reagent (Allihn's and Bertrand's) to 3 cc. in a centrifuge tube, stopper and place in a boiling H_2O bath for 1.5 min. After cooling 1.5-2 min., centrifuge the tube, wash the pptd. CuO with 1 cc. H_2O and centrifuge. Dissolve the ppt. in 0.3 cc. of 1% HNO_3 and add 0.2 cc. concd. NH_4OH . Compare the blue color with the color given by treating Cu reagent with NH_4OH , 1 cc. of which = 0.5 mg. Cu = 0.25 mg. glucose. F. A. CAJORI

Chemical blood analysis. M. RICHTER-QUITNER. *Biochem. Z.* 158, 176-92 (1925).—A review of methods in vogue in blood analysis and the results of analysis of rabbit blood and plasma with special reference to the mineral constituents. F. A. C.

A muscle-nerve chamber. H. C. STEVENS AND ENOCH KARVER. *J. Optical Soc. Am.* 11, 427-33(1925). E. H.

Non-polarizable electrodes for physiological purposes. H. C. STEVENS AND ENOCH KARVER. *J. Optical Soc. Am.* 11, 423-6(1925). E. H.

Estimations of sugar in small quantities of blood. D. G. C. TERVAERT. *Biochem. J.* 19, 541-3(1925); cf. *C. A.* 19, 1722.—This is a modification of the method proposed by Shaffer and Hartman (*C. A.* 15, 1327). **Solution 1.**—phosphotungstic acid 5 g., Na sulfate 20 g., H_2SO_4 2 g., water to 1000 cc. **Solution 2.**—Cu sulfate crystals 1.5 g., tartaric acid 3.75 g., Na carbonate (anhyd.) 40 g., KI 2 g., KIO_3 0.2 g., water to 1000 cc. Mix the blood with 25 vols. of soln. 1. For 1 detn. and a blood-sugar content between 0.07 and 0.2% take 6.8 cc. of soln. 1 and add 0.2 cc. of blood. If more than

0.2% of blood sugar is present, take 50 cc of soln. 1. When the blood sugar is lower than 0.07%, dil. with 10 vols. of soln. 1 and take more blood. Mix thoroughly. The hemoglobin settles to the bottom as hematin in a few min. Filter. Pipet 5 cc. of filtrate into a test tube of 23 mm. diam., add 5 cc. of soln. 2, cover with a well-fitting glass cover in the form of a small cryst. dish. Keep in boiling water bath for 15 min. Cool in water. Add 5 cc. $N H_2SO_4$, mix well, again cover the tube and shake at intervals during 2 min. Titrate the liberated I with thiosulfate (0.08 N is a convenient strength). Calc. the amt. of Cu from a formula. The amt. of glucose corresponding to the amt. of Cu is supplied in a table.

BENJAMIN HARROW

Urea estimations on small quantities of blood. JOCELYN PATTERSON. *Biochem. J.* 19, 601-3(1925).—To 1 cc. of 0.6% KH_2PO_4 in a flat-bottomed, stout glass tube add the blood sample (0.2-0.5 cc.) from a capillary pipet. Add 0.2 g. ground soy bean meal and incubate at 40° for 15 min. Add 4 cc. satd. K_2CO_3 soln. and 2 g. solid K_2CO_3 together with a few drops of caprylic alc., and attach the tube for aeration to H_2SO_4 and titration tubes in the usual way. The titration tube contains 5 cc. 0.01 N H_2SO_4 if 0.5 cc. of blood is available, or 2 cc. dild. with 2 cc. water if 0.2 cc. of blood is available, and 3-4 drops of indicator made up of 100 cc. of 0.02% methyl red and 30 cc. of 0.1% methylene blue. Aeration requires about 1 hr. For 0.5 cc. blood (blood reading—blank reading) cc. $\times 60$ = mg. urea per 100 cc. blood; for 0.2 cc. blood, cc. $\times 150$ = mg. urea per 100 cc. blood.

BENJAMIN HARROW

Use of the glass electrode in biochemistry. P. T. KERRIDGE. *Biochem. J.* 19, 611-7(1925).—The use of the glass electrode is discussed and its technic described. The original paper must be consulted for the details.

BENJAMIN HARROW

The "third component" or heat-stable factor of complement. H. R. WHITEHEAD, JOHN GORDON and ARTHUR WORMALL. *Biochem. J.* 19, 618-25(1925).—The inactivation of guinea-pig serum by the action of yeast can also be effected by a zymoin prep'n. The serum so obtained can have its complement activity renewed by the addition of serum inactivated by heating at 56°. Yeast and zymoin heated in normal saline or in the dry condition at 100° for 1/2 to 1 hr. are more efficient inactivators than the unheated substances, and thus the inactivation process does not appear to be one of enzyme action. Kaolin and charcoal are not similar to yeast in their action on serum. B. H.

Estimation of acetoacetic acid and β -hydroxybutyric acid in urine. M. W. GOLDBLATT. *Biochem. J.* 19, 626-32(1925).—A modification of Lublin's method (*C. A.* 17, 1258), applied to small vols. of urine. To 4 cc. urine add 4 cc. water, 4 cc. basic lead acetate (see Shaffer, *C. A.* 8, 352) and 2 cc. NH_4OH . Allow to stand 5 min., filter, add 3.5 cc. of the filtrate to a Kjeldahl flask contg. 40 cc. water. (The flask is provided with an inlet tube, through which an air current can be drawn, and through which the dichromate- H_2SO_4 mixt. can be introduced. The flask is fitted to a condenser connected to an Erlenmeyer flask, which in turn is connected to a suction pump.) Add 5 cc. of 25% H_2SO_4 . In the Erlenmeyer flask place 40 cc. water, 10 cc. 0.02 N iodine and 2 cc. 25% $NaOH$. Heat and aerate for 25 min., and aerate for 5 more min. Add 5 cc. 20% HCl to the receiver and titrate with 0.0005 N thiosulfate. For β -hydroxybutyric acid, make up the vol. in the Kjeldahl flask to 40 cc. and connect another receiver contg. the same quantities of iodine, etc. Add $K_2Cr_2O_7 \cdot H_2SO_4$ (2 g. $K_2Cr_2O_7$, 20 cc. concd. H_2SO_4 , made up to 100 cc. water). Distil and titrate as before. B. H.

Coloration of cilia and cellular elements difficult to stain. F. PULGER. *Spermiomentele* 79, 483-91(1925).—A tannic acid-crystal violet-dil. HCl mixt. is used.

M. HEIDELBERGER

The identification of glycerol by a bacterial method. A case of probable glyceroluria. ALDO CASTELLANI and F. E. TAYLOR. *J. Trop. Med. Hyg.* 27, 271-3(1924).—A report on the possibility of using the mycological-bacteriological method for the identification of various C compds. The organisms employed are: *Mortilia krusei*, Castellani, *M. pinoyi* C., *M. metalondinensis* C., *M. tropicalis* C., *M. macedoniensis* C., *B. asiaticus* C., *B. paratyphosus* B. Schottmüller, *B. columbensis* C. (strain J). It is essential to use only selected strains of the organisms with const. characteristics and with large production of gas. This work is applied to the identification of a case of glyceroluria.

FRANCES KRASNOW

Intravital staining with neutral red as a means of determining the ionic concentration of live organs. P. CARNOT, R. GLÉNARD and GRUZEWSKA. *Compt. rend. soc. biol.* 92, 865-8(1925).—A 1% soln. of neutral red is injected intravenously into rabbits (10-30 cc. depending upon the size of the animals) or into the lymphatic sac of frogs, and 10 min. later the animals are quickly killed by bleeding. No satisfactory way has been found to preserve the color of the tissues but the fresh sections are photographed by a color process which reproduces with great accuracy the different shades

of coloration from red to yellow. The original must be consulted for details. With regard to glands, the results seem to indicate that the cellular reaction is acid when the product of secretion is alk. and *vice versa*. S. MORGULIS

• • • Adjustment of p_H of culture media under sterile conditions. L. M. CHRISTENSEN AND E. J. FULMER. *Ind. Eng. Chem.* **17**, 935(1925).—An app. which may be sterilized is described for adjusting the p_H of culture media. F. W. TANNER

C—BACTERIOLOGY

A. K. BALLS

The mechanism of shortening of the lag period in bacterial cultures containing certain food accessory substances. G. SCHWARTZMAN. *Proc. Soc. Exptl. Biol. Med.* **22**, 178–82(1924).—The food accessory substances of tomato ext. "rejuvenate" *B. dysenteriae* (Shiga) so that active multiplication begins shortly after inoculation. C. V. B.

Fungus starch (amylose) in *Aspergillus niger* and some remarks on its diastatic decomposition. D. SCHMIDT. *Biochem. Z.* **158**, 223–52(1925).—The starch prep'd. from cultures of *Aspergillus niger* was identical with amylose as far as its reaction with I indicated. No glycogen was found. Hydrolysis of this starch with H_2SO_4 or diastases from molds gave products giving a red color with I. Products giving a blue color with I were produced when hydrolysis was effected by malt or pancreatic diastases. The formation of this starch is influenced by the N-carbohydrate ratio of the medium, the lower the ratio the greater the starch formation in the fungus. F. A. C.

The products of metabolism of yeast growth and fermentation and their relation to race and environment. H. LÜERS AND ZEZA OPEKAR. *Wochschr. Brau.* **42**, 49–52, 55–7(1925).—The action of various yeasts when subjected to fermentation is described. Tables show the quantities of fixed esters, acid, CO_2 and alc. formed. A discussion of formol titration, optimum p_H for fermentation and kinds of alc. produced is given. C. N. FREY

The influence of sugar on the growth and development of yeast. G. A. NADSON AND V. H. ZELENEKKAJA. *Wochschr. Brau.* **42**, 133–4(1925).—*Schizosaccharomyces octosporus*, Beijer, was used in these expts., and growth and spore production in varying concn. of sugar were studied. Lower concn. gave larger cells and better spore production. Above 50% sugar the yeast no longer fermented. C. N. FREY

Biochemical activities of *B. botulinus*, Type C and *B. Parabotulinus*, "Seddon." XXIII. E. WAGNER. *J. Infectious Diseases* **35**, 352–60(1924); *Abstracts Bact.* **9**, 46; cf. *C. A.* **18**, 1511.—A comparative study of various strains of *B. botulinus* of the following types: A, B, C, *parabotulinus* Seddon and an atypical C strain which showed the following: Type C and para strains do not grow on anaerobic blood agar plates and their growth in liquid media is spasmodic. The same strains produce little change in the amino acid, NH_3 and non-protein N content. As det'd. by microscopic and chem. examn., it was found that the organisms autolyze. Exo-enzymes such as are present in A and B types are not demonstrable in C cultures. Slight utilization of sugar further suggests a low metabolic rate. Toxin production is not necessarily associated with proteolytic activity. H. G.

The biochemistry of acetone formation from sugar by *Bacillus acetoehtylicum*. H. B. SPEAKMAN. *J. Biol. Chem.* **64**, 41–52(1925).—Cultures of *B. acetoehtylicum* in media otherwise identical but contg. glycerol, maltose or glucose, resp., were tested for gas formation and presence of pyruvic acid and AcMe. Gas formation was most prompt in the glycerol medium but pyruvic acid was formed only after several days and then only in small quantities. In the sugar media, larger quantities of pyruvic acid were formed and its presence was demonstrated on the 2nd day. AcMe could be detected after the 7th day and was formed in the greatest quantity in the maltose medium and least in the glycerol medium. In an 18-day expt., maltose yielded 10.3% AcMe and 24.1% EtOH; whereas glycerol yielded 1.0% AcMe and 37.3% EtOH. Pyruvic acid added to a culture in the glycerol medium was rapidly fermented with the formation of AcMe but the yield was only about 0.5 that calcd. from the scheme: $2CH_3COCOOH \rightarrow 2CH_3CHO \rightarrow CH_3CH(OH)CH_2CHO \rightarrow CH_3COCH_2CH_3$. Some other product must be formed. S. believes pyruvic acid to be one of the primary products in the fermentation of the sugars. By the addition of H_2O , it yields AcOH and $HCOOH$; by reduction, lactic acid or a mixt. of AcH and CO_2 . Further reduction of AcH yields EtOH. But AcH may also change as follows: $2CH_3CHO = CH_3CH(OH)CH_2CHO$; $CH_3CH(OH)CH_2CHO + CH_3CHO + H_2O = CH_3CH(OH)CH_2CO_2H + CH_3CH_2OH$; $CH_3CH(OH)CH_2CO_2H + CH_3CHO + H_2O = CH_3COCH_2CO_2H + CH_3CH_2OH$;

$\text{CH}_3\text{COCH}_2\text{COOH} = \text{CH}_3\text{COCH}_3 + \text{CO}_2$. S. believes that pyruvic acid and AcH are also formed from glycerol but that more H_2 is also formed, leading to increased reduction of AcH to EtOH and avoidance of the reactions leading to AcMe. I. G.

Fermentation products of certain mannitol-forming bacteria. H. R. STILES, W. H. PETERSON AND E. B. FRED. *J. Biol. Chem.* 64, 643-54 (1925).—Of 4 strains of mannitol-forming bacteria isolated from cereals, I fermented both xylose and arabinose, II only arabinose, III only xylose and IV neither. When fermented, both sugars yielded HOAc and lactic acid. All 4 fermented fructose, with the formation of lactic acid, HOAc, CO_2 and mannitol. All 4 fermented sucrose and all but I formed small quantities of mannitol from it. Raffinose was partially fermented by I and III with the production of CO_2 , HOAc, EtOH and mannitol. Glucose was fermented with the production of EtOH, CO_2 and lactic acid. Galactose and lactose were attacked to a lesser degree but, if fermented, gave similar products. The lactic acid formed, in all cases, was mainly inactive. III slowly fermented Ca lactate with the formation of volatile acid. It had a similar slow action on mannitol, forming lactic acid, HOAc and, probably, CO_2 . I. GREENWALD

The influence of washing upon the reproductive rate of *Colpidium colpoda*. D. W. CUTLER AND L. M. CRUMP. *Biochem. J.* 19, 450-3 (1925).—*Colpidium colpoda* alloecatalysis does not occur under the conditions in which Robertson (*C. A.* 19, 1013) has detected it. BENJAMIN HARROW

Studies on the growth of yeast. I. The influence of volume of culture medium employed. G. I. PESKERT. *Biochem. J.* 19, 464-73 (1925).—In the absence of "bios" no const. effects on growth of yeast were observed as a result of differences in the vol. of medium used; in the presence of "bios," the quickest growth occurred in larger vols. than the slowest. The results are not in accord with Robertson's theory of an extracellular autocatalyst for growth. II. A further note on allelocatalysis. *Ibid* 474-6.—The failure to observe allelocatalysis in the expts. recorded above was not due to the omission of the precaution of washing the cells before inoculation, as Robertson (*C. A.* 19, 1013) alleges. BENJAMIN HARROW

Fermentation by dried yeast preparations. ARTHUR HARDEN. *Biochem. J.* 19, 477-83 (1925).—Air-dried yeast and zymine (acetone-yeast) produce fermentation rapidly in a small vol. of sugar soln., only after considerable delay in a large vol. The addn. of yeast ext. or solns. of certain salts such as acetates or bicarbonates greatly accelerates the onset of fermentation in the presence of a large vol. of sugar soln. Air-dried yeast possesses a definite fermenting power which is not dependent on the presence of living cells. BENJAMIN HARROW

Bactericidal action of some organic compounds of mercury. T. A. HENRY, T. M. SHARP AND H. C. BROWN. *Biochem. J.* 19, 513-9 (1925).—The introduction of a Hg residue into the mol. of an org. compd. enhances the bactericidal action of the latter. The 2 groups $-\text{CHO}$ and $-\text{OH}$, taken together, are most effective in the m -position to each other and least effective in the p -position. The entrance of a nitro group into a 1-CHO, 3-OH compd. enhances the effect in position 4 but exerts no influence in positions 2 or 6. With the alkyl phenols, the increase of bactericidal activity due to the introduction of Hg residues is much less marked; there is a considerable reduction in the bactericidal action of both org. and inorg. compds. of Hg when they are used in serum in place of water. BENJAMIN HARROW

Dehydrogenations produced by resting bacteria. I. J. H. QUASTEL AND M. D. WHEATHAM. *Biochem. J.* 19, 520-31 (1925); cf. *C. A.* 19, 3103.—An account in given of the behavior of a no. of substances as H donors in the presence of resting *B. coli* as the activating source and of methylene blue as the H acceptor. The inhibiting action of the monohydric alcs. is discussed. BENJAMIN HARROW

Theories of carbon dioxide assimilation. J. S. PETRUS BLUMBERGER. *Chem. Weekblad* 22, 425-36 (1925); cf. *C. A.* 12, 1792, 1889, 2090; 14, 2011, 2504, 2652; 15, 248, 1035, 1336; 16, 3463; 17, 1980, 2302; 18, 848-9; and Willstätter and Stoll: Untersuchungen über Chlorophyll.—A review with numerous references. MARY JACOBSEN

Utilizable metabolism of acid-fast bacteria. IV. The utilizable metabolism of the tubercle bacillus of typhus humanus and typhus bovinus. S. KONDO. *Biochem. Z.* 155, 148-58 (1925); cf. *C. A.* 19, 2510.—Tubercle bacilli from man and from the cow were cultured upon a mixt. of salts to which were added various org. substances. Formic, propionic, butyric, lactic, succinic, malic, tartaric and citric acids were found not to be utilizable as a source of C, but AcOH was so utilized. MeOH, EtOH and mannite were not utilized, but glycerol was. Glucose was utilized, varying rates of growth resulting. Levulose and arabinose were not utilized. As sources of N, glycocoll, alanine, asparaginic acid, leucine, tyrosine, urea and uric acid each proved inadequate. W. D. LANGLEY

Relation between hydrogen-ion concentration and alcoholic fermentation. I. E. HÄGGLUND AND ANNE M. AUGUSTSON. *Biochem. Z.* **155**, 334-47 (1925).—The relative rate of fermentation by yeast, measured by the rate of evolution of CO_2 , in buffer mixts. of H_3PO_4 , lactic, acetic and pyruvic acids at different p_{H} values is observed. For the 1st half hr., the optimum p_{H} is 4.5, but changes in some cases, during the next 1.5 hrs. to 6. W. D. LANGLEY

Assimilation of paraffin by microorganisms. W. O. TAUSON. *Biochem. Z.* **155**, 356-68 (1925).—*Aspergillus* is grown upon solns. of salts with known amts. of paraffins dispersed in them. After 5 weeks, no differences are detd. in the rate of growth upon paraffins m. 78° and 58° nor on vaseline. Of the paraffin 75% is utilized. Max. growth occurs at $p_{\text{H}} = 7.7$. The paraffins are turned yellow, but no acids are formed, although esters in traces may be present. Growth upon starch, maltose, glucose, mannitol, glycerol and peptone are compared. Nitrates are utilized as easily as NH_3 . W. D. L.

Vital staining and photodynamic phenomenon. ALEXANDRA EFIMOV AND V. V. EFIMOV. *Biochem. Z.* **155**, 376-80 (1925).—Most vital stains kill protozoa in light and stained infusoria live much longer in the dark. However, the addn. of proteins protects them from destruction by light. W. D. LANGLEY

Regularity of lactic acid fermentation. AUGUSTE LUMIERE. *Ann. inst. Pasteur* **37**, 997-9 (1923); cf. *C. A.* **18**, 2731; **19**, 839.—In tubes seeded with lactic acid bacilli and treated with 0.0005 part per 1000 HgCl_2 violent mech. agitation with production of foam led to irregularity in the amt. of fermentation. However when the production of foam was avoided the amt. of fermentation was invariably the same. The irregularity in the first case is to be attributed to the mech. isolation of the bacilli from their substrate by the foam. E. R. LONG

Radioactivity, fixators of nitrogen and alcoholic yeasts. E. KAYSER AND H. DELAVAL. *Compt. rend.* **181**, 151-3 (1925); cf. *C. A.* **18**, 3001, 3247.—During a period of 8 months *Azotobacter agilis* had its N-fixing power increased 133% by the addn. of 3 mg. per 100 (g. ?) of a radioactive mineral from the Congo, and 215% by the addn. of 4 mg. With *A. comore* the increases were 80.6 and 36.3%, resp. Addns. of 2, 3 and 4.5 mg., resp., of radioactive mineral to a medium undergoing alc. fermentation showed the greatest fermenting power with 3 mg. per 100, but the largest quantity of N fixed per g. of sugar utilized was after the addn. of 4.5 mg. per 100. L. W. R.

The acetone-producing organisms (FOWLER, SUBRAMANYAN) 16.

D—BOTANY

B. M. DUGGAR

The presence of β -methylglucoside in the leaves of *Scabiosa succisa*. L. N. WARTIEZ. *J. pharm. Belg.* **7**, 81-5 (1925).—By extn. with water and subsequent purification, 4.55 kg. of the fresh leaves of *Scabiosa succisa* yielded 3.045 g. of a cryst. glucoside which was identified as β -methylglucoside; m. $102-104^\circ$; $\alpha_D = -32.09^\circ$. On hydrolysis with H_2SO_4 the glucoside yielded 85.89% of reducing sugar calcd. as glucose; with emulsin the yield of reducing sugar was 87%. In addn., the leaves also yielded scabiosin, an amorphous glucoside isolated and identified by Bourquelot and Bridel (*J. pharm. chim.* **21**, 119 (1920); cf. *C. A.* **14**, 1525). A. G. DuMEZ

Absorption of ions from the soil through the root system of plants. J. STOKLASA. *Ber. botan. Ges.* **42**, 183-91 (1924).—Detns. are recorded of (1) the p_{H} of the sap in the roots of various cultivated plants, (2) the amt. of CO_2 excreted per unit weight of the roots, (3) the nos. of bacteria in the soil in the neighborhood of the roots and (4) the amt. of CO_2 respired per unit weight of the soil by the bacteria present. Contrary to the results of other workers, the H-ion concn. of the sap of the roots of plants grown in normally aerated soil was in no case found to be sufficiently high to account for the absorption of mineral constituents from the soil. The p_{H} figures varied only from 6.2 for buckwheat to 6.9 or 7.0 for wheat, barley and potatoes. The amt. of CO_2 excreted by the roots varied with different plants, but had no relation to the p_{H} of the sap. By growing plants in an artificial soil under sterile conditions and supplied with N in the form of NH_4 salts, it was shown that the various species used possessed characteristic powers of preferential absorption of anions or cations, e. g., cereals and buckwheat take up anions (phosphate) more readily than cations (potash), while beet and potatoes absorb more cations than anions. The yield from such cultures was much increased on inoculation with active bacteria from soil surrounding the roots of the same species of plant, indicating the important part played by bacteria in the absorption of mineral materials by the roots. The no. of bacteria found in the neighborhood of the roots

are different for different species of plants grown in the same soil; and these differences are reflected in the amt. of CO_2 respired by the soil. No appreciable differences were noticed in the p_{H} of the soil near the roots of the various plants. Conclusion: The absorption of difficultly sol. mineral nutrients by the root system of plants is brought about entirely by the action of CO_2 excreted by the roots and by CO_2 and org. acids produced by bacteria. B. C. A.

Influence of salinity of water on germination and growth of halophytic plants. G. POMA. *Bull. sci. acad. roy. Belg.* 8, 81-99(1922).—The seeds of various plants were allowed to germinate, etc., in presence of brackish water obtained by mixing fresh and sea-water. A relation exists between the germinative power of seeds and the osmotic pressure of the medium, that is, an increase in the osmotic pressure increases the duration of germination and diminishes the no. of seeds that germinate; germination ceases when a certain osmotic pressure is reached, and this pressure is characteristic for each plant. For growth, there is an optimum characteristic osmotic pressure for each plant, but the medium which is best for germination is not that which most favors growth. Plants show a remarkable adaptation to the osmotic pressure of the medium. The power subsequently to germinate is not removed even when seeds are left in contact with solns. possessing osmotic pressures of 44 atm. On the other hand, after such treatment they germinate very rapidly in presence of fresh water and the ultimate growth of the plant is increased. A useful rough method of finding the osmotic pressure of various samples of brackish water is to det. the d. (referred to 4°). If the d. is 1.0 *ab* (*ab* being not a product, but representing sep. digits) the osmotic pressure of the sample will be *ab* atm. Thus if the d. is 1.011, the osmotic pressure will be 11 atm. B. C. A.

Preparation of asparagine by the diffusion method. A. PIUTTI. *Rend. accad. sci. Napoli* [iii], 30, 188-91(1924).—The young growing cells of new vegetable tissues consist of an external membrane and protoplasmic contents which gradually contract, forming an inner membrane. The outer membrane is permeable to water and crystalloids, whereas the inner one is semipermeable and allows only water to traverse it. At a certain stage, varying in different cases, this internal membrane is, however, permeable also to carbamide, glycerol, various alkaloids, nitrates and asparagine. This observation forms the basis for a method of isolating asparagine from *Lupinus albus* and *Vicia sativa* by diffusion into water. The stems may be dried in the air and extd. later, the yield of asparagine being virtually the same as is given by the fresh material. Even in presence of toluene, the enzymes of the cotyledons rapidly destroy the asparagine of the dialyzed liquid. B. C. A.

The question of photosynthesis of carbohydrates. M. J. GALWIALO. *Biochem. Z.* 158, 65-75(1925).—If the electrolytes derived from the ash of the roots of plants and an enzyme extd. from chlorophyll-contg. leaves are present, a reducing sugar is produced in a soln. of CO_2 in H_2O when exposed to sunlight. On keeping such a soln. 4 days in the sunlight the sugar content is diminished and a solid, giving a blue color with I, seps. on evapn. from the soln. F. A. CAJORI.

Potato leaf roll as affecting the carbohydrate, water and nitrogen content of the host. E. G. CAMPBELL. *Phytopathology* 15, 427-30(1925).—Detns. upon aerial parts of Rural New Yorker at 5.5 weeks and Irish Cobbler and Early Ohio at 11 weeks showed in all cases a much larger content of total carbohydrate and lower N and water content in plants with leaf roll than in healthy plants. The diseased plants were higher in reducing and non-reducing sugar and in polysaccharides. The carbohydrate-nitrogen ratio of the leaf-roll plants was much higher than that of normal plants. The disease may retard the transpiration stream, stimulate photosynthetic activity, or both. J. S. C.

A new secretin in the stinging nettle (Urtica). MINKO DOBREFF. *Munch. med. Wochschr.* 71, 773-4; *Chem. Zentr.* 1924, II, 676.—A new secretin was isolated by air-drying the leaves, warming them with 8% H_2SO_4 , filtering and almost neutralizing the filtrate. On subcutaneous injection it caused an increase in the amt. and the acidity of the gastric juice in a manner similar to spinach secretin. C. C. DAVIS.

Plasmolysis caused by salts of heavy metals. K. O. PRINGSHEIM. *Beih. Botan. Zentr.* 41, 1-14(1924); *Chem. Zentr.* 1925, I, 852-3.—Zn, Ni, Co, Fe, Mn and Cu sulfates, like $\text{Al}_2(\text{SO}_4)_3$, cause plasmolysis in plant cells. With suitable objectives the limiting concns. which cause plasmolysis can be detd. without difficulty, and frequently the cells can be deplasmolyzed in H_2O if the treatment has not been too prolonged. In the plasmolyzed cells the plasma movement can be maintained for a long period, a proof of the continuation of life. The poisonous action of salts of heavy metals is therefore considered to be a time reaction which leads to coagulation and death of the cells only after a more or less protracted time. C. C. DAVIS.

The carbon dioxide supply of the chloroplastids. H. SCHROEDER. *Flora N. F.* **17**, 270-92; *Chem. Zentr.* **1925**, I, 1088.—CO₂ migrates by diffusion partly into the intercellular spaces (gaseous phase) and partly in the dissolved state through the walls of the assimilation cells and through the chlorophyll granules themselves (H₂O phase). To det. from the diffusion formula the const. at the phase boundaries, the attempt was made to measure the requisite factors, including the cross-section and the length of the path of diffusion and the diffusion const. In spite of the coeff. of hydrodiffusion being 10,000 times greater than the abs. resistance in the H₂O phase it was only 4.5 times as great as that of the gaseous phase, which shows the great importance of the intercellular spaces. C. C. DAVIS

The existence of tyrosine in "Shoyu-Moromi." MATAO YUKAWA. *J. Coll. Agr. Tokyo* **5**, 291-9 (1924); *Chem. Zentr.* **1925**, I, 1499-1500.—A study is made of the problem whether tyrosine is formed by enzymes of *Aspergillus oryzae* in the "Koji" stage or in the early ripening stage of the "Moromi" from the protein of beans and wheat, the raw material of "Shoyu," and then suffers further decompn. on continued ripening, or whether the greater part of the seed protein is attacked by microorganisms during the ripening process. From "Shoyu" and "Tamari-Shoyu," tyrosol and tyrosamine were isolated, the former being identified by its dibenzoate and the latter by its chloroplatinate and its benzoate. Fungi isolated from "Shoyu-Moromi" were grown in nutrient solns. contg. 0.1% tyrosine and the fermentation products were studied. *Zygosaccharomyces soja*, *Z. major* and *Z. japonicus* produced tyrosol, but no tyrosamine or *p*-hydroxyphenyllactic acid, whereas in *Monilia* and *Mycoderma* cultures, which were isolated only from "Koji," *p*-hydroxyphenyllactic acid and tyrosol, but no tyrosamine were detected. Conclusion: Tyrosamine originates in "Shoyu" or "Tamari" from tyrosine or from its decompn. products, or directly from the proteins in "Moromi" by the aid of *Aspergillus oryzae*. The stimulating action of "Shoyu" and of "Tamari," which are widely used in Japan as spices, depends upon their contg. tyrosamine, which according to Bickel and Pavlov (*C. A.* **8**, 1833) causes contraction of the blood vessels. C. C. DAVIS

Some effects of freezing on mature fruits of the apple. D. B. CARRICK. *Cornell Agr. Expt. Sta. Memoir* **81**, 55 pp., 4 figs., 7 plates (1924).—A potentiometric app., including specially constructed thermoelements for precise measurements of the f.-p. depression of cell sap in plant tissue, is briefly described. The extreme f. ps. of 1552 detns. in 10 apple varieties extend from -2.85° to -1.02°. The min. av. depression is -2.60° in the Baldwin; the max. av. is -1.54° in the Wagener. The point of ice formation and the lethal point in apple tissue are not identical. The latter may be less than 1° lower than the f. p., but in some cases there is a difference of nearly 3°. Rapidly frozen apples exhibit a larger amt. of discoloration than do similar fruits requiring 4 times as long an interval to reach the same min. temp. Apples frozen rapidly to varying degrees, when thawed at 0° and 22°, show an equal amt. of browning injury. But slowly frozen apples when thawed very slowly during several days or weeks at 0° uniformly reveal more discoloration. F. ps. of expressed apple juice are significantly higher than the depression of the cell sap within the normal, unfrozen tissue. The depression of the cell sap within the tissue frozen to death is much higher than that of the expressed juice. P. R. DAWSON

The anthocyanins. P. M. NIKIFOROVSKY. *Z. physiol. Chem.* **146**, 91-7 (1925).—Instead of the classification into 6 or more groups, all anthocyanins may be grouped together on the basis of a new color reaction with AlCl₃. The pigment is extd. with 50% EtOH, but in certain cases where the color rapidly fades it is advisable to use stronger EtOH or formalin. Addn. of a few drops of AlCl₃ soln. to the ext. gives a beautiful blue or red coloration which is quite permanent and is not destroyed by boiling. The red color is obtained with blossoms which contain anthocyanin in the form of pelargonin and the blue color where the anthocyanin is present as cyanine or delphinine. The difference in color produced is probably dependent upon the no. of free OH groups in the mol. Where pigments other than anthocyanin are responsible for the color of the blossoms, the reaction with AlCl₃ is negative. In testing for anthocyanins in leaves, the extn. is performed with 95% EtOH and a few drops of benzene are added along with the reagent in order to sep. chlorophyll and its accompanying pigments. Colored juices of fruits and berries contg. considerable acid should be nearly neutralized with alc. KOH after extn. The reaction is strictly sp. for anthocyanins and is not obtained with flavonols. Tannins, although related to the anthocyanins, give only a yellow color. A. W. DOX

Behavior of alkaloids of alkaloid-containing seeds during germination. TH. SABALITSCHKA AND C. JUNGERMANN. *Pharm. Zentralhalle* **66**, 474-7, 501-6 (1925).—

It appears from an exptl. study that no diffusion of alkaloids takes place from the seeds of *Lupinus luteus*, *Datura stramonium*, *Trigonella foenum graecum* and *Strychnos nuxvomica* during germination of normal character. It is therefore no part of the normal function of these alkaloids to develop a protective zone in such alkaloid-containing seed. The appearance of alkaloids in the germination H_2O was observed only in the event of excessive moisture in the germination bed, a condition inimical to healthy germination. Emphasis is laid on the fact that even the growing *strychnos* plant shows no protective action on the part of the alkaloid; on the contrary, the leaves of the plant in spite of their high alkaloidal content showed unusual devastation from insect pests. The conclusion drawn by Tunmann from the observed decrease in alkaloidal content during germination of the seed was pertinent though incorrect. S. and J. also observed a diminution in the alkaloidal content of germinating seed. The alkaloids are consumed for some purpose as yet unexplained, concerning which a later report is promised.

W. O. F.

The photosynthesis of carbohydrates. W. WINDISCH. *Wochschr. Brau.* 42, 141-2 (1925).—A brief review of the theories proposed to account for the formation of sugar from CO_2 is given.

C. N. FREY

Problems of the chemistry of hops. PAUL KOLBACH. *Wochschr. Brau.* 42, 157, 163-6 (1925).—Methods of analyses, products found and various applications of chemical technic to the chemistry of hops are discussed.

C. N. FREY

Method of studying the permeability of protoplasm. O. WALTER. *J. Russian Botan. Congress* 1, 70-1 (1921); *Botan. Abstracts* 14, 285.—A description is given of the method of studying permeability by means of the optical lever. "This method has significant advantages (use of solns. that do not involve plasmolysis, practically instantaneous change of the acting factors, reduction of the duration of the expts. to 1 min., etc.)." A series of expts. is described, which illustrates the method and proves the sensitiveness of the object to changes of concns. of the order of 0.0001 N. Examples are given of direct detns. of the suctional power of the cells under natural conditions.

H. G.

Studies on the permeability of protoplasm to salts. O. WALTER and M. OSTROVSKII. *J. Russian Botan. Congress* 1, 72 (1921); *Botan. Abstracts* 14, 286.—The investigation is not yet finished. Expts. are reported concerning the repeated action of salt solns. of the same concn.; the influence of change of concn. on plasmolysis and recovery; the state of equil. in H_2O and in salt solns.

H. G.

Physiological antagonism of acids and neutral salts. M. DOMONTORICH. *J. Russian Botan. Congress* 1, 37-8 (1921); *Botan. Abstracts* 14, 289.—Comparison was made of the toxicity of solns. of HCl and HNO_3 with the toxic action of the same acids in salt solns. on the leaves of *Elodea* and on pieces of red beet root. The degree of toxicity was measured by the quantity of non-plasmolyzed cells. Chlorides and sulfates of Ca, Sr, Mg and Na promote the stability of the cells to withstand the toxic action of acids. Anions of strong acids when sufficiently diluted do not influence the protective power of the salts; cations may be placed in the following order according to their protective activity: $NH_4 < Na < K < Mg < Ba < Sr < Ca$. Other expts. with beet root gave the following range of rising protective activity: $NH_4 < Na, K < Mg, Mn < Na, Sr < Ca < Al$. Comparisons were made of the action of acids and mixts. of acids and salts on the growth of wheat roots. Salts of $CaSO_4$, $CaCl_2$ and $Sr(NO_3)_2$ restrained the toxicity of HNO_3 .

H. G.

The acidity of Sphagnum and its relation to calcium carbonate. M. KORSKOV. *J. Russian Botan. Congress* 1, 89 (1921); *Botan. Abstracts* 14, 289.—*Sphagnum* absorbs Ca from solns. of $CaCO_3$. Absorption is more rapid, the higher the concn. of the soln. or the greater the quantity of $CaCO_3$ per unit of fresh weight of the moss in solns. of the same concn. Under the influence of $CaCO_3$ on the *Sphagnum* the alkali of the soln. diminishes and the acidity of the moss also becomes lower. When $CaCl_2$ soln. acts on the *Sphagnum*, Ca is absorbed in smaller proportions than from isosmotic solns. of $CaCO_3$. $CaCO_3$ is more vigorously absorbed by species of mosses which possess a higher acidity.

H. G.

Catabolism of proteins in germinating seed. A. OPARIN. *J. Russian Botan. Congress* 1, 22 (1921); *Botan. Abstracts* 14, 296.—Oxidation of the products of protein hydrolysis combined with their decompn. and with splitting off of NH_3 can be produced with chlorogenic acid, widely spread in the plant world. In the presence of chlorogenic acid and O_2 , α -amino acids and peptones are decomposed in germinating seed by the splitting off of free α -amino groups in the form of NH_3 .

H. G.

The relation of plants to ammonia. D. PRIANISHNIKOV. *J. Russian Botan. Congress* 1, 65-7 (1921); *Botan. Abstracts* 14, 296-7; *Z. Pflanzenernähr. Düngung* 4A,

242-50(1925); cf. C. A. 18, 101.—P. considers the significance of NH_3 in nutrition and as a product of metabolism, and the conditions of rapid consumption of NH_3 in the formation of asparagine in the presence of carbohydrates. Expts. using NH_4NO_3 with different reactions of the nutrient media have shown that the acid reaction increases the consumption of NO_3 and decreases that of NH_4 . Expts. with $(\text{NH}_4)_2\text{SO}_4$, when the soln. was constantly changed at short intervals, have shown that the harmful action of this salt depends not upon the NH_4 group as is sometimes taken for granted, but only upon the H_2SO_4 (the acid fragments remaining after the absorption of NH_4 were removed by a const. change of soln.; the plants thrived). The N of NH_4 is distributed between the amino and amide groups, but P. points out that sometimes there is a disagreement in detns. of asparagine (Sachs' method) when the sum of N in asparagine, in protein and in NH_3 equals the whole quantity of N and nothing is left for the amino acids. In this case apparently the amino group belongs not only to the asparagine but the 2nd carboxyl group of asparagine is substituted by an amido group (formation of the diamide of aspartic or maleic acid). These cases require further investigation, for it is possible that they contain the solution of problems connected with "ammonia poisoning of starving seedlings." H. G.

The permeability of protoplasm. D. SABININ. *J. Russian Botan. Congress* 1, 35(1921); *Botan. Abstracts* 14, 297.—Colorimetric detns. were made of changes in concns. of the ions NH_4 and NO_3 after the roots of the seedlings had been placed in the soln. The immersion of the roots is immediately followed by a decrease in the concn., detd. for NH_4 salts as equaling 5-30%. In greatly diluted or highly concd. solns. the adsorption is weaker. When continuously left in the soln. the seedlings slowly absorb the salts. Acidity of the media decreases adsorption and delays the entrance of NH_4 , but increases adsorption and accelerates the entrance of NO_3 . Addn. of alkali, on the contrary, increases adsorption and accelerates entrance of NH_4 but diminishes adsorption and retards entrance of NO_3 . NH_4NO_3 changes its character in relation to physiol. acidity and alky. independently of the change of reaction of the medium. H. G.

The specific action of certain irritants on the leaves. LUIGI MONTEHARTINI. *Atti. ist. bot. Univ. Pavia* [III], 1, 1-12(1924); *Botan. Abstracts* 14, 434.—M. studies the action of CuSO_4 , strychnine and EtOH on the respiration, photosynthesis, transpiration and translocation of minerals in leaves of *Glycine* and other plants. Dil. solns. of CuSO_4 accelerate photosynthesis and translocation, increase the amt. of Ca in the leaves during the day and decrease it during the night and decrease transpiration. Strychnine decreases photosynthesis but increases respiration and transpiration, increases the sensibility of the plant to light and favors the formation of compds. of P and K, opposing the formation of those of Ca. EtOH (1%) decreases respiration but increases photosynthesis, transpiration, and the accumulation of Ca, P, and K, but stops their translocation at night. H. G.

The constancy of the living substance. [Experiments made on *Spirogyra*.] V. LEPESHKIN. *Studies Plant Physiol. Lab. Charles Univ. Prague* 1, 5-44(1922); *Botan. Abstracts* 14, 434-5.—Using 4 unidentified species of *Spirogyra*, L. studied the stability or "constancy" of living substance with reference to the influence of temp., mech. pressure, light, H ions, OH ions, EtOH , lipid-sol. substances and glycerol. In the effect of high temp. 4 (or 5?) phases are distinguishable. The time necessary for a certain phase varies with the different species of *Spirogyra* as well as with the different cells of the same thread. On the av., the temp. coeff. for heat coagulation was 1.4. The effects of high temp. expressed in the 1st 2 phases may be annulled by the synthetic processes of the cell by which the denatured proteins are reconstructed. When heating is prolonged to the 3rd phase, coagulation results, the synthetical processes do not suffice and the cell dies. Denaturation of cell proteins produces death by bringing about the decompn. of the protein-lipoid substances. Such decompn. may be effected also by mech. means which, like heat, act especially on the superficial strata of protoplasm. Mech. effects operating with high temp., therefore, reduce the coagulation time of the living substance. The constancy of living substance is decreased by light, H ions, EtOH and by narcotics in relatively high concns., on account of the accelerating effect of these agents on the denaturation of proteins. OH ions in very small concn., narcotics in weak concns. acting for a short time and glycerol in weak concn. increased constancy. In weak concns., narcotics of high dielec. const. and little capacity to absorb proteins increase constancy even when operating for weeks. H. G.

Permeability of protoplasm to salts and anatonosis. W. S. ILJIN. *Studies Plant Physiol. Lab. Charles Univ. Prague* 1, 97-119(1923); *Botan. Abstracts* 14, 436.—I. attacks the problem of permeability by studying the phenomenon of deplasmolysis—

i. e., the recovery after a variable period of a normally turgid condition in cells plasmolyzed by exposure to salt solns., without the tissues concerned being removed from the soln. A variety of plants—including *Rumex acetosa*, *R. confertus*, *R. maritimus*, *Cirsium canum*, *Ranunculus repens*, *Beta vulgaris*, *Pisum sativum*, *Ficaria ranunculoides*, *Erysimum strictum*, *Aster tripolium strictum* and many others—were used in these expts. Slices of epidermis were exposed to various concns. of agents like NaCl, BeCl₂, LiCl, CaCl₂, KCl, RbCl, SrCl₂, BaCl₂, glycerol, saccharose, maltose and lactose, and the condition relative to plasmolysis, recovery from plasmolysis, turgidity as expressed by the degree to which the stomata were found open, and the correlated conservation or disappearance of starch grains, were observed at appropriate intervals. Conclusion: Recovery from plasmolysis is not brought about primarily by the entrance of the plasmolyzing agent into the protoplast, but by the induced production within the cell of a substance increasing osmotic pressure, this, in the cases studied, being sugar derived from the hydrolysis of starch grains. Such hydrolysis begins soon after immersion in the solns. being induced evidently as a result of the adsorption by the protoplasm of a very small quantity of the salt in question, rather than by general infiltration of the salt into the cell in quantity great enough to bring about directly any considerable deplasmolysis.

H. G.

The preparation and properties of monotropitoxide. M. BRIDEL AND P. PICARD. *Bull. soc. chim.* 37, 1028–33 (1925).—See *C. A.* 19, 2838.

H. G.

The physiological significance of anthocyanin. W. GLEISBERG. *Ber. Höher. Staatl. Lehranst. Obst Gartenbau Proskau* 1920–21, 87–93; *Expt. Sta. Record* 48, 432.—Studies applied to *Vaccinium oxycoccus*, which has anthocyanin coloring matters in blooms, fruits and winter leaves, indicate that the behavior of anthocyanin is not uniform even in the same plant, different parts of which may show different chem. processes in connection with this colorant.

H. G.

Effect of solar radiation on the cultivation of belladonna and the formation of alkaloids in the leaves. A. GORIS AND H. DELUARD. *Bull. sci. pharmacol.* 29, 74–6 (1922); *Physiol. Abstracts* 8, 72.—A plant of *Atropa belladonna* was grown in the sun, a second in the shade and a third 6 weeks in shade and then 6 weeks in the sun. The yields of alkaloid per 100 g. dried leaf for the 3 plants were, resp., 0.52 to 0.65, 0.39, 0.42 g.

H. G.

Studies of photosynthesis in marine algae. B. MOORE, E. WHITLEY AND T. A. WEBSTER. 36th Ann. Rept. Oceanography Dept., Liverpool, 1922; *Physiol. Abstracts* 8, 72.—Algae are so arranged on the littoral that each kind receives an intensity of illumination best suited for the color scheme of its chromophylls, the reds synthesizing best in weak, the green best in strong, the brown in medium intensities. The effect of red pigments is thus not a negative one of screening, but, like the green chlorophyll, it exerts a positive catalytic action. The alkyl. on titration to phenolphthalein developed in the water in which weeds are grown is taken as a measure of photosynthetic activity. Red rays are most effective, though light from very different parts of the spectrum is also active.

H. G.

Occurrence of a pectic substance in beech wood. M. H. O'DWYER. *Biochem. J.* 19, 694–6 (1925).—By extg. with hot dil. (NH₄)₂C₂O₄ and pptg. with HCl a substance is obtained corresponding to the pectic acid obtained by Schryver (*C. A.* 16, 733) from unliquefied tissue.

BENJAMIN HARROW.

Investigations on the assimilation of chlorophyll. R. WURMSER. *Trav. Inst. Physiol. Gen. Strassbourg* 1919–22, 110 pp.; *Physiol. Abstracts* 8, 186.—A detailed account of researches. Treats of general methods of photochemistry, the photo-oxidation of chlorophyll, action of radiation of different wave-lengths on chlorophyll and on C assimilation by the plant, and assimilation by red algae. The original should be consulted by all interested in the important problems discussed. The main point is that chlorophyll is an optical sensitizer, and that what happens in or upon it is only the first stage of a process which is continued in the protoplasm structures. Phycoerythrin acts as a sensitizer in the red algae.

H. G.

The specific action of plant enzymes. I. The specific conditions of the action of leaf invertases. A. V. BLAGOVESHENSKII AND N. I. SOSSIEDOV. *Biochem. J.* 19, 350–54 (1925).—The aq. exts. from air-dried powd. leaves of 14 species of wild and cultivated plants were investigated. A definite optimal H-ion concn. exists for each plant species. These expts. support Willstätter's and Kuhn's view (*C. A.* 18, 91), that there are as many invertases as sources from which they are obtained. II. The specific conditions of the action of leaf peptases. *Ibid* 355–6. What is true of the invertases is true of peptases: the optimal peptase action of various plants is very varied.

B. H.

• Pectin content of normal and "silvered" apple leaves. FRANK TETIN. *Biochem.*

J. 19, 414-5(1925).—Leaves affected by "Silver Leaf" disease contain less pectin than do normal leaves
BENJAMIN HARROW

Oxidizing enzymes. VIII. The oxidation of certain *p*-hydroxy compounds by plant enzymes and its connection with tyrosinase. M. W. ONSLOW AND M. E. ROBINSON. *Biochem. J.* 19, 420-3(1925); cf. *C. A.* 18, 3205.—When an enzyme prepn. from the potato tuber acts on either *p*-cresol, tyrosol or phenol a dihydroxy deriv. is formed which gives rise to peroxide and subsequent blueing of guaiacum. B. H.

The chemical nature of the membrane of potato cork. EDGAR RHODES. *Biochem. J.* 19, 454-63(1925).—The suberin lamella of the cork cell arises by changes taking place in the fatty material resulting in the appearance of bodies no longer sol. in fat solvents.
BENJAMIN HARROW

The persistence of vitamin A in plant tissues. K. H. COWARD. *Biochem. J.* 19, 500-6(1925).—Vitamin A appears to increase when a leaf loses its green color and becomes yellow; it is completely destroyed when the leaf dries up and dies. B. H.

Physiological study of the symbiotic germination of orchid seeds. LEWIS KNUDSON. *Bot. Gaz.* 79, 345-79(1925); cf. *Bot. Gaz.* 73, 1(1922); 77, 212(1924).—A fungus isolated from *Cattleya*, *Cypripedium* and *Epipactis* is capable of inducing seeds of *Cattleya* to germinate on a medium contg. starch. The fungus may permit of complete germination or may kill every seed in the culture. One of the factors which controls the degree of infection is the concn. of starch used. The fungus is not necessary for germination, at least for seeds of *Cattleya*.
BENJAMIN HARROW

Conditions for germination of spores on *Onoclea sensibilis*. C. E. HARTT. *Bot. Gaz.* 79, 427-40(1925).—Spores of *Onoclea sensibilis* germinate best in diffused light, the optimum temp. being 28°.
BENJAMIN HARROW

Physiological and anatomical investigations on *Mimosa pudica*. JAGADIS BOSE AND G. P. DAS. *Proc. Roy. Soc. (London)* 98B, 290-311(1925).—*Mimosa pudica* contains conducting or nervous tissue. The energy of the rapid movement is derived from oxidation of an active substance present in the protoplasmic contents of cells of excitable pulvini. This active substance is highly oxidizable and reactive, and is an unsatd. compd. with double or triple bonds. It is not a lipin for it is insol. in alc. and H_2O ; it combines with Br and reduces OsO_4 . JOSEPH S. HEPBURN

Discoloration of the skin and finger nail by ingredients of plants. K. PICHLER. *Wiener Arch. inn. Med.* 10, 569-74(1925).—A list is given of plants which on handling produce a not easily removed discoloration of the skin or finger nails. This effect is attributed generally to their tanning content. Pyrogallie acid has also been held responsible. Walnut hulls in addn. to tannin contain derivs. of juglone, a hydroxy- α -naphthoquinone which like pyrogallie acid becomes brown in alk. soln. exposed to the air.
HARRIET F. HOLMES

A reliable detection of smoke injury. W. RIEDE. *Mitt. deut. Landw.-ges.* 38, 423-4(1923).—Exptl. plots or pots are planted at different distances from the source of smoke and the degree of injury detd. by comparison with plants grown under identical conditions in smoke-free atm. K. D. JACOB

Fixation of gaseous nitrogen by higher plants other than the legumes. G. TRUFAUT AND N. BEZSSONOV. *Science du sol* 4, No. 1, 3-53(1925); cf. *C. A.* 19, 2360.—In the presence of N-fixing bacteria corn developed normally and grew to maturity in a medium originally deprived of N and org. compds. capable of serving as food for plants and bacteria. The energy requirements of the bacteria were supplied by org. compds., chiefly malic acid, present in the secretions of the plant roots. The presence of sugars and other carbohydrates could not be detected. The ratio of N fixed to energy-forming material utilized approached 1:1 in some instances, as compared with the best ratio 1:50 obtained in lab. cultures and soils receiving addns. of sugar or cellulose. At the end of the expts. with corn, the authors were unable to establish the presence of *Azotobacter chroococcum* although this species was introduced at the same time as cultures of *Clostridium pastorianum* which could be easily detected at all times. A bibliography of 92 references is appended.
K. D. JACOB

Pectic substances of plants. III. The nature of pectinogen and its relation to pectic acid. F. W. NORRIS AND S. B. SCHRYVER. *Biochem. J.* 19, 676-93(1925); cf. *C. A.* 16, 733.—Pectic acid is probably the basal mol. of the pectic substances. Pectic acid may be regarded as a ring with 6 sides, these corresponding to 1 mol. of galactose, 1 mol. of arabinose, and 4 of galacturonic acid, the carboxyl groups of the lact being free. Pectinogen occurs in the cell wall as a methylated pectic acid in loose combination with metallic ions such as Ca and may be obtained by extg. the cell-wall substance with warm 0.5% soln. of $(NH_4)_2C_2O_4$ or $H_2C_2O_4$. Alkalies convert pectinogen to pectin.
BENJAMIN HARROW

The vertical mixing of sea water and its importance for the algal plankton. W. R.

G. ATKINS. *J. Marine Biol. Assoc.* **13**, 319-24(1924).—Measurements of H-ion concn., of phosphate concn. and of temp., all showed at certain seasons a well-marked gradient from surface to bottom. The upper 10-20 m. is more alk., notably depleted of phosphates and warmer. Settled summer weather and deep water, free from irregularities of the bottom, favor the formation of such a gradient. Its breaking up is occasioned by wave action and the cooling of the surface water in autumn. Thermal stratification in the English Channel arises at each station and is not due to the inflow of warm over cold water.

N. KOPELOFF

The thermal stratification of sea water and its importance for the algal plankton. W. R. G. ATKINS. *J. Marine Biol. Assoc.* **13**, 693-9(1925).—Considerations of d., temp. and salinity are recorded. The mixing of surface water with deeper is less readily brought about in summer than in winter, both on account of the lesser amt. of wind and the increased differences in d. The warm surface layer, or epilhalassa, is depleted of phosphate by the phytoplankton and as long as it persists, the phosphate in the deeper layers is not fully utilized. The stability or otherwise of the epilhalassa is consequently of great importance.

N. KOPELOFF

Seasonal changes in the phosphate content of sea water in relation to the growth of the algal plankton during 1923 and 1924. W. R. G. ATKINS. *J. Marine Biol. Assoc.* **13**, 700-20(1925).—The cerulo-molybdate colorimetric method of Denigès was employed with Helmer tubes for comparison in preference to either a Dubosq or Kober colorimeter. The seasonal changes closely resembled previous findings. Samples obtained from the tropics showed that even in winter phosphate may be much diminished, for the light is bright. The periodic alterations in phosphate content are therefore suppressed or much reduced compared with the temperate zones. It is indicated that in arctic latitudes the sea becomes even richer in phosphate during the winter than in England; accordingly the summer development of phytoplankton is all the more abundant.

N. KOPELOFF

Seasonal changes in the water and helioplankton of fresh-water ponds. W. R. G. ATKINS AND G. T. HARRIS. *J. Marine Biol. Assoc.* **13**, 750-4(1925); *Sci. Proc. Roy. Dublin Soc.* **18**, 1-21(1924).—The seasonal changes in the helioplankton of 2 fresh-water ponds have been compared with alterations in the solutes and it has been shown that in each there was a vernal rise in p_H followed by a period of stagnation with lowered p_H .

N. K.

Plant cuticles. I. Modern plant cuticles. Studies in the composition of coal. V. H. LEGG AND R. V. WHEELER. *J. Chem. Soc.* **127**, 1412-21(1925).—The cuticle of *Agave americana* was sepd. into 4 distinct classes of compds: (1) H_2O -sol., 10% contg. 48% C; (2) wax, 15% sol. in $EtOH$, C_6H_6 and $CHCl_3$, contg. 79% C; (3) cellulose, 14% sol. in cuprammonium soln. and (4) a residue, 60% insol. in preceding reagents and contg. 68% C. The residue is termed *cutin*. The chief product of the action of KOH on cutin consisted of 2 semi-liquid acids which form K salts sol. in H_2O . The greater portion of this forms a Cu salt sol. in $EtOH$ in agreement with formula $C_{26}H_{30}O_6$ for the acid. The other portion forms a Cu salt insol. in $EtOH$ and is in agreement with the formula $C_{12}H_{22}O_5$ for the acid. The name *cutic acid* is suggested for the former and *cutinic acid* for the latter. Two other acids were obtained in small quantities. One acid forms a K salt sparingly sol. in H_2O and has a compn. in agreement with $C_{13}H_{24}O_6$. The other forms an insol. K salt.

H. R. KRAYBILL

The diffusion of ions from living plant tissues in relation to protein isoelectric points. W. H. PEARSELL AND J. EWING. *New Phyt.* **23**, 193-206(1924).—The rapid outward diffusion of Cl ions occurs when plant tissue is brought to a H-ion concn. equal to or greater than that at which its chief protein (potato, carrot) or protoplasm (*Nitella*) is isoelec. The method may be used to det. the isoelec. point of the protoplasm in tissues from which extn. of protein is difficult. In this manner the isoelec. point of protoplasm of the beet was detd. at or below p_H 4.3.

H. R. KRAYBILL

The effects of an artificially controlled hydron concentration upon wound healing in the potato. G. A. C. HERKLOTS. *New Phyt.* **23**, 240-55(1924).—Atm. O is necessary for suberization and meristematic activity. Acetates in acid buffer solns. are toxic to potato tissues. All buffer jellies kill at acid but not at alk. p_H . Disintegration of pectic substances never occurs with buffers more acid than p_H 5.0. The fats released by the potato are unsatd., most mobile at high hydron concn., but most easily oxidized at low hydron concn. Alky. promotes suberization but retards meristematic activity.

H. R. KRAYBILL

First sugar of photosynthesis and the role of cane sugar in the plant. J. H. PRIESTLEY. *New Phyt.* **23**, 255-65(1924).—A general discussion of the subject is given with a bibliography of 26 references. Conclusion: the data really support the theory that

hexoses rather than sucrose are the primary photosynthetic sugars. The theory is advanced that sucrose is not directly connected with the synthesis or hydrolysis of starch but is a secondary product in the metabolism of the cell. H. R. KRAYBILL

Role of the ash constituents in plants. II. The influence of neutral salts upon peroxidase. A. J. SMIRNOV. *Biochem. Z.* **155**, 1-33(1925); *C. A.* **19**, 2226.—The pyrogallol formed by the action of peroxidase upon pyrogallol in the presence of neutral salts was filtered and oxidized by standard KMnO_4 . The extent of oxidation which had taken place gives the relative activity of the enzyme at the various salt concns. The greatest activity occurred at $p_H = 8.8$, above which it decreased very rapidly. The activity of $N/20$ and $N/80$ solns. of chlorides of NH_4 , Li, Na, K, Rb, Mg, Ca, Zn, Sr, Ba and Mn are detd. Near $p_H = 6.5$ only the salts NaCl and KCl affect the oxidation potentials of the system $\text{Fe} + \text{H}_2\text{O}_2$ and peroxidase $\neq \text{H}_2\text{O}_2$. ZnCl_2 stops the reaction. Not only does the activity of peroxidase differ with different salts, but it also varies with the diln. of each. The chlorides of the alk. earths, which are the principal metals found in the ash of peroxidase, favor its reaction more than do other chlorides. Ferric tartrate is weaker than CaCl_2 in its influence upon peroxidase, and HgCl_2 , when it does not ppt. the peroxidase with other colloids, enhances its action. The influence of KCl and CaCl_2 when used together is additive. The effects of the anions HPO_4^{--} , H_2PO_4^- , NO_3^- , SO_4^{--} and Cl^- are studied in as great detail as are the cations. W. D. L.

Physiological equilibrium in plants. The dependence of the growth constant of corn (*Zea mays* L.) upon the nitrogen food. A. RIPPEL AND G. LUDWIG. *Biochem. Z.* **155**, 133-47(1925).—Corn was sprouted in sand upon a mixt. contg. const. quantities of KH_2PO_4 and K_2SO_4 , but with diff. quantities of NH_4NO_3 . The rate of growth did not vary with the change in N as calcd. by the curve of Robertson, $K = [1/(x-x_1)] \log [y/(A-y)]$, where y = yield of dry plant in time x , A = the yield in time x_1 , and K = a const. K increases with increase of N. W. D. LANGLEY

Plant tyrosinases. F. BOAS AND F. MERKENSCHLAGER. *Biochem. Z.* **155**, 197-227(1925).—Leaves of the potato and a number of other plants show darkened veins when dipped in solns. of quinine sulfate. Tests showed the same to be true in certain seeds and tuberous roots. This coloration is due to melanin formed in the presence of tyrosinase. The reaction was not given by *Fusarium* or yeast, nor in the press juice of potato. Alkali salts but not salts of the alk. earths lead to melanin formation. Quinol and catechol produce the color spontaneously, while resorcinol does not. W. D. LANGLEY

Production of cholesterol by mushrooms. RÉMOND AND H. LASSALLE. *Compt. rend. soc. biol.* **93**, 426(1925).—*Penicillium glaucum* uses up the carbohydrates of its medium transforming them into fatty acids, lipoids and cholesterol. S. M.

Effects on moisture and of exposure to sunlight on lupine (*Lupinus angustifolius* L.) and on the alkaloids of the seed. H. MALAVSKI AND J. SYNPIEWSKI. *Pamiętnik Państwowego Instytutu Naukowego Gospodarstwa Wiejskiego w Pulawach* **4**, 302-27(1923); *Rev. internat. renseign. agr.* **3**, 548-50(1925).—The expts. showed that soil humidity and degree of exposure to sunlight affect the alkaloid content of the seeds. Comparison of the seeds used for sowing and those obtained in the expts. showed that with H_2O contents equal to 20% and to 65% of the moisture capacity of the soil the seeds contained 50% more alkaloids than the original seeds, while with 35-50% of the moisture capacity the alkaloid content was lower than that of the original seeds. Plants grown in the shade gave seeds contg. nearly twice as many alkaloids as those grown with normal exposure; and seeds from plants grown in diffuse daylight contained 2.5 times as much as those from plants with normal exposure. A. PAPINEAU-COUTURE

Diurnal changes in the acidity of *Bryophyllum calycinum*. F. G. GUSTAFSON. *J. Gen. Physiol.* **7**, 719-28(1925).—There is a diurnal change in the H-ion concn. of this plant which corresponds approx. to the changes in total acidity. H-ion concn. increases at night and decreases during the day. Light is the main factor causing a decrease in acidity, temp. and perhaps O_2 are also detg. factors. External O_2 tension apparently does not influence acidity or the decompn. of the extd. juice. C. H. R.

Accretion and distension in plant cells. D. T. MACDOUGAL. *Am. Nat.* **59**, 336-45(1925).—Growth consists of synthesis or condensation of proteins and carbohydrates in the accumulation of materials in initial elements preceding and following mitosis, and subsequent hydrolysis and distension. The formation of proteins and of lipins characterizes the earlier stage. Beginning with the appearance of pentosans in the cell plate, condensation of the sugars progresses with a consequent increase of mucilages in the plasma and cellulose of the wall. Hydrolysis or hydration of the pentose-protein plasma may be tentatively attributed to the action of acidic or

basic amino compds., which, emanating from the nucleus, may be carried into the cytoplasm by the chondriosomes, and are freed from the chondriosomes by incoming electrolytes. The greatest distension of a cell takes place at a p_H , and under other conditions of electrolytic action in which the complex layer is in a condition of least permeability. Turgidity or increase in vol. of the cell is detd. by the permeability of the plasmatic layers and walls, especially to the substances in the cell sap, and is the resultant of the combined action of all charged particles or ions which enter into or impinge on the cells on the one hand, and by the activity of the cell-sap on the other.

L. W. RIGGS

Formation of essences. (Mlle.) H. POPOVICI. *Compt. rend.* **181**, 126-8 (1925).—A cytological study of *Philodendron*, *Kleinia*, *Parthenium*, *Dahlia*, *Glechoma*, *Quercus*, etc. is reported.

L. W. RIGGS

Does light exercise a direct action upon the decomposition of the chlorophyll of leaves in autumn? RAOUL COMBES. *Compt. rend.* **181**, 129-30 (1925).—Chestnut leaves shortly before yellowing time were covered with tinfoil and their yellowing was compared with that of leaves exposed to light. Maple leaves were enclosed in glass cylinders of which selected cylinders were covered with several coats of black varnish so that the enclosed leaf was entirely deprived of light. The yellowing of such leaves was compared with that of leaves in unvarnished cylinders. Light has no direct action upon the disappearance of chlorophyll in the leaves in autumn. The differences in the rapidity of yellowing of leaves in light and in shadow are attributed to the influence of light upon the nutrition of the leaves during the entire vegetative season. L. W. R.

Equilibrium of cellular constituents and form of oxidations in the cell. Imbibition and respiratory types in revived plants. ANDRÉ MAYER AND L. PLANTEFOL. *Compt. rend.* **181**, 131-2 (1925); cf. *C. A.* **18**, 2361.—A study of *Hypnum triquetrum* L. indicated that the respiratory quotient, which is near unity for mosses satd. with water, is lowered for mosses with an imbibition above 1 and is decidedly raised for mosses with an imbibition of less than 0.6. It attains 13.7 for mosses with an imbibition of 0.25. With dry mosses the ratio CO_2/O_2 is still a respiratory quotient. With slight imbibition the "anhydrobiose" detcs. a process of "anerobiose." For both satd. and dry mosses the respiratory quotient decreases with the time.

L. W. RIGGS

Mineralization of green leaves and of chlorotic leaves. H. COLIN AND A. GRANDSIRE. *Compt. rend.* **181**, 133-5 (1925).—In chestnut leaves the ratio of mineral to org. matter from Apr. 17 to June 19 averaged 0.074 in the green leaves and 0.103 to 0.138 in the yellow leaves. Elm leaves showed an av. of 0.087 and 0.159 for green and yellow leaves, resp. During the same period the sol. alky. of the ash of green leaves of both plants was always less than that of yellow leaves, while the total alky. was always greater in the green leaves. Analysis of the ash of leaves of both plants showed CaO to be much greater always in green leaves, MgO was slightly greater in green leaves, K_2O was much less in green than in yellow leaves, SO_3 and P_2O_5 were slightly less in green leaves.

L. W. RIGGS

Presence of crystals of calcium oxalate on the surface of certain Caryophyllaceae. P. R. BOHN. *Compt. rend.* **181**, 135-7 (1925).— CaC_2O_4 was identified on the surface of several species of *Lychnis*, and on *Spergula arvensis*, before and during the flowering period. The crystals are easily washed from the surface and require a magnification of 600 to 1000 diameters for their satisfactory study. The presence of CaC_2O_4 on the surface of cells confirms the idea that this salt is a waste product and indicates an important role for the epidermal cells in its elimination.

L. W. RIGGS

The phosphorus content in red fir and spruce with special regard to the production of charcoal. H. v. ECKERMANN. *Jernkont. Ann.* **108**, supplementary issue, 115-91 (1924).—The investigations were made on a scale sufficiently large to eliminate the influence of accidental divergences. In accordance with earlier results those of E. make certain that bark and twigs contain considerable more P than the stockwood; the sapwood contains several times more P than the heartwood; the P content of the former is considerably reduced by leaching during floating; and the P content may differ widely in wood from trees grown in different localities. But contrary to conclusions drawn by earlier investigators E. has found that the P content varies with the age of the trees, since the ratio between the amt. of heartwood and sapwood will increase with the age and also with the cutting season. The stock and bark have least P in summer and most in early springtime, whereas the twigs contain the most P during the vegetation period and least in winter. These variations correspond to an amplitude of up to 0.0125% P in stock wood charcoal. The heartwood as well as the sapwood show a decided reduction in the P content during the floating, the reduction proceeding more quickly in red fir than in spruce wood. The efficacy of the leach-

ing is reduced by an increase in the salt content of the water. The lowest P content reached by such leaching ranged about 0.0003% in heartwood and 0.002-0.0015% in sapwood, the limit being reached in 1-2 years. The following precautions should be taken if a charcoal extremely low in P is called for: Twigs and bark should be removed before burning. Old trees should be preferred to younger ones. The trees should be cut between June 15 and Aug. 15. A long floating time also will assist in reducing the P content. C. H. A. ROBAK

The role of the hydrogen-ion concentration on the development of pigment in *Fusarium*. C. P. SIDERIS. *J. Agr. Research* 30, 1011-9(1925).—The development of pigment by *Fusarium* is mainly controlled by the H-ion concn. of the culture media. In dextrose solns. pigment was produced by practically all the different species studied at H-ion concns. between 3.5 and 5.5, where the initial p_H value was maintained const. by the addition of adjusting reagents. In cultures, however, whose H-ion concn. was not maintained const., pigment was produced at p_H 3.0, 4.0, 5.0, 6.0, 7.0 and 7.5. The color which a pigment may take depends on the H-ion concn. of the surrounding culture soln. The movement of the H and OH ions released by the reaction of the metabolic products of *Fusarium* through solid culture media is very slow. W. H. R.

Effect of seeds upon hydrogen-ion concentration equilibrium in solution. WILHELM RUDOLFS. *J. Agr. Research* 30, 1021-6(1925).—Seeds immersed in solns. of mineral and org. acids and in representative salt solns. are able to change the H ion concn. of the solns. to a certain extent and in all solns. a certain equil. is reached after the seeds have been immersed for a sufficient period. The changes of the solns. in which previously soaked seeds were immersed are very similar to the changes in solns. caused by air-dry seeds. The reaction caused by seeds dried at 102° is similar to the reaction changes caused by fresh seeds, although the rate of reaction is slightly less. The cotyledons of soy beans absorb ions from solns. more readily than the seed coats, but the reaction changes caused by seed coats of corn are similar to the changes brought about by the whole seeds. The chem. properties of the chief protein constituents of the seeds is thought to be responsible for the changes in H-ion concn. of the solns. W. H. ROSS

Wyoming forage plants and their chemical composition. A. T. CUNDY. Wyoming Agr. Expt. Sta., *Bull.* 137, 3-16(1924).—The chem. analyses of a number of grasses are given collected at different periods during the haying season. The crude protein content in practically all plants decreased at later stages in the season. Other changes were variable. J. J. SKINNER

Plasmolysis form and the action of ether. FRIEDL WEBER. *Arch. ges. Physiol.* (Pflüger's) 208, 705-17(1925).—Exposure of *Spirogyra* and other plant cells to solns. contg. ether changes the plasmolysis form, the alteration being due to a reduction in the viscosity of the limiting layer of protoplasm. G. H. S.

The possibility of anaphylactic sensibilization in vegetables. B. LONGO AND A. CESARIS-DEMEE. *Atti accad. Lincei* [6] 1, 694-8(1925).—Lumière and Couturier (*C. A.* 15, 2903) reported positive results on anaphylactic sensibilization in plants by injecting heterogeneous albuminoid substances. In the expts. here given the results were all negative and it is believed that no other result can be obtained by methods used. The phenomenon appears to be restricted to animals. R. J. WITZEMANN

Formation of organic from inorganic compounds under the influence of light (BAUDISCH) 3.

LIPPMAN, EDMUND O. VON: *Geschichte der Rübe (Beta) als Kulturpflanze von den ältesten Zeiten an bis zum Erscheinen von Achard's Hauptwerk (1809)*. Berlin: Julius Springer. 184 pp., G. M. 12. Reviewed in *Chemistry and Industry* 44, 736 (1925).

E-NUTRITION

PHILIP B. HAWK

Oil activated by irradiation. II. Separation into an antirachitic and an inactive fraction. A. F. HESS, M. WEINSTOCK AND D. HELMAN. *Proc. Soc. Exptl. Biol. Med.* 22, 76-7(1924).—The unsaponifiable fraction of ultraviolet irradiated cottonseed oil protected rats against rickets. The rat blood contained twice as much inorg. P as the controls. The saponifiable fraction was inert. C. V. B.

Digestibility of crude fiber as influenced by the composition of the ration. F. HONCAMP, E. KOCHS, E. MÜLLER AND W. SCHRAMM. *Landw. Vers. Sta.* 103, 179-208 (1924).—Three series of nutrition expts. with sheep led to the following conclusions:

Addition of a food very rich in protein (gluten) to a ration in which carbohydrates and crude fiber predominate (clover-hay) does not bring about an increased breaking down of the crude fiber or if such action takes place it is not reflected in an increased digestibility of the fiber. Addition of already fermented material, such as soured beet-slices, to a ration rich in carbohydrates is without notable influence on the digestibility of the total ration or of the individual nutriment. B. C. A.

The effect of piperidine on calcium deposition. S. ÉDERER. *Biochem. Z.* 158, 193-6 (1925).—While less effective than cod-liver oil, piperidine when added to a rickets-producing diet to the extent of 0.5-1.5% of the diet delayed the onset of exptl. rickets in the rat as indicated by Shipley's "line test." Such a result suggests a working hypothesis for the detn. of the chem. make-up of the antirachitic factor. F. A. C.

The action of vitamins A and B on unbalanced diets. S. ÉDERER. *Biochem. Z.* 158, 197-202 (1925).—Vitamin B has a favorable influence on protein and carbohydrate assimilation on diets made up of one or the other of these foodstuffs. On fat-rich diets vitamins A and B must be present to enable rats to survive. Yeast is more effective than cod-liver oil in aiding animals to maintain their wt. on these unbalanced diets. A. CAJORI.

Recent progress in vitamin research. S. S. ZILVA. *J. Soc. Chem. Ind.* 44, 445-50T (1925).—A lecture. E. J. C.

Structure of lemon peel.—Vitamin content. S. G. WILLIMOTT AND FRANK WOKES. *Perfumery Essent. Oil Rec.* 16, 260-1 (1925).—From animal expts. the conclusion is drawn that lemon peel contains appreciable quantities of vitamin. In males growth was continued steadily up to the 50th day, when the av. wt. was 76% of the normal, while the females, after growing slowly for 36 days, were practically at a standstill. Proof of the existence of considerable quantities of vitamin in lemon peel is in accordance with the results obtained by workers on the peels of other citrus fruits. W. O. E.

Hydrogen-ion concentration of gastric contents of infants. F. L. ABBOTT, JR., J. A. JOHNSTON, C. H. HASKINS AND A. T. SHOHL. *Am. J. Diseases Children* 26, 475-85 (1923); *Expt. Sta. Record* 51, 166-7.—Data are reported on the H-ion concn. of the gastric contents of infants as influenced by digestion time, previous type of feeding, age of the subject and amt. and concn. of the test meal. The detns. were made in all cases on the gastric contents obtained after a test meal of powd. milk and water, the standard meal consisting of 8 parts of milk to 100 parts of water. The p_H values were detd. by the colorimetric method of Shohl and King (*C. A.* 14, 3432). The normal range of H-ion concn. of the gastric contents from the milk test meal at the end of an hr. was from p_H 3.2 to p_H 5, with 76% of the readings between p_H 3.9 and 4.6. The acidity increased with time and age. The previous type of feeding had no effect. An increase in the concn. of the test meal to 4 times the original concn. decreased the H-ion concn. of the gastric contents. Doubling the amt. of the test meal, while causing a stimulus of acid secretion, also caused a lessened acidity of the gastric contents. H. G.

Antirachitic effect of cod-liver oil fed during the period of pregnancy or lactation. A. F. HESS AND M. WINSTOCK. *Am. J. Diseases Children* 27, 1-5 (1924); *Expt. Sta. Record* 51, 267; cf. *C. A.* 19, 847.—Cod-liver oil when fed to female rats during the last half of pregnancy or during the lactation period had no protective influence on the young when the latter were placed on rickets-producing diets subsequent to weaning. When administered directly to the young during the lactation period, the oil served to protect against the development of rickets at a later period. This is thought to indicate that the active principle is not transferred in appreciable amts. to the milk of lactating animals, but is capable of being stored by the young when fed directly. It is noted that in this connection the factor of growth must be taken into consideration. Evidence is advanced that storage of antirachitic vitamin is not so great in a rapidly growing animal as in one in which the growth processes are not so marked. H. G.

Study of artificial nutrition in the pigeon and of vitamin deficiency. J. HOET. *Biochem. J.* 17, 220-9 (1923); *Physiol. Abstracts* 8, 257.—A diet of casein, fat, starch, salts, cellulose and ext. of yeast is sufficient to maintain pigeons and to permit reproduction and growth of the young. Vitamin A does not appear to be necessary to the adult pigeon. H. G.

The nutritional value of milk. E. V. MCCOLLUM, H. T. PARSONS AND E. KALMBACH. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* 1, 421-37 (1923); *Expt. Sta. Record* 52, 662-3.—A general report, with selected data, is given of a demonstration on an extensive scale of the value of milk as a supplement to a qualitatively insufficient diet for children. The children not receiving milk were apathetic and tractable, while those receiving milk showed greater restlessness and desire for activity. H. G.

The optimum amount of milk for children. H. C. SHERMAN. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* 1, 445-7(1923); *Expt. Sta. Record* 52, 563.—This paper consists essentially of a brief review of the study by Sherman and Hawley of C and P metabolism in childhood (*C. A.* 16, 3684), which showed the optimal amt. of milk for growing children to be about 1 qt. a day. From the long-continued investigation which is being conducted in S.'s lab. of the effect through successive generations of limited and ample amts. of milk, a further recommendation is made as follows: "In view of such evidence, it seems a mistake to limit the recommendation of a qt. of milk per day to the ages from infancy to puberty. Undoubtedly it would better be extended, probably to all ages." H. G.

The value of iron in anemia. An experimental study. C. S. WILLIAMSON AND H. N. ERS. *Arch. Intern. Med.* 36, 333-54(1925).—Rats kept on the standard casein diet of Osborne and Mendel, without the addn. of the Fe lactate to the salt mixt., showed a complete recovery of the hemoglobin content of the blood 5 weeks after bleeding 30% of the total blood vol. No increase in hemoglobin content above this was observed in rats receiving inorg. Fe in their food. This procedure was repeated with the same result and even a third bleeding, with only 2 weeks between the bleeding and the blood examn., gave the same result. Analyses of livers and spleens showed storage of Fe, particularly in the spleens, in rats receiving added Fe in the food. In dogs on a diet of bread and milk, the hemoglobin content of the blood was reduced by repeated bleedings. Subcutaneous or intravenous injection of Fe and NH_4 citrate did not accelerate the return to normal hemoglobin values, but substitution of some of the bread by an isodynamic amt. of meat did. "In the light of the foregoing expts., the administration of inorg. Fe has no therapeutic value in anemia." I. G.

Basal metabolism as affected by atmospheric conditions. W. J. MCCONNELL AND C. P. YAGLOU. *Arch. Intern. Med.* 36, 382-96(1925).—Dry and wet bulb temp. and velocity of air are reduced to a single index, called the effective temp., that shown by thermometer in still air satd. with H_2O . The min. rate of metabolism is at an effective temp. of 75-83° F. Rectal temp. and pulse rate both show good correlation with metabolism. I. GREENWALD

The metabolism of obesity. IV. CHI CHE WANG AND SOLOMON STROUSE. *Arch. Intern. Med.* 36, 397-417(1925); cf. *C. A.* 19, 1001.— O_2 consumption, respiratory quotient and N excretion in 26 tests on obese subjects, 21 on thin and 12 on normal subjects after ingestion of meals rich in protein, carbohydrate and fat, resp., led to the following conclusions. After a fat or carbohydrate meal, all groups showed an increase in the metabolism of the fat or carbohydrate, resp. After a protein meal, however, the increase in metabolism of protein observed in the normal or thin persons was not found in the obese, in whom the metabolism of carbohydrate increased and that from fat diminished. There was no relation between the pulse rate and the heat produced per sq. m. of body surface. I. GREENWALD

The Jendrassik reaction for water-soluble B. Concerning Victor E. Levine's critical study. NIKOLAI BEZSSONOV. *J. Biol. Chem.* 64, 589-90(1925).—Claim for priority (*C. A.* 18, 1689, 2191, 3207) as against Levine (*C. A.* 19, 669). The reaction is given in greater diln. and more rapidly by di- and polyphenols than by monophenols. I. GREENWALD

The Jendrassik reaction for vitamin B with reference to the work of Bezssonov and of Levine. V. E. LEVINE. *J. Biol. Chem.* 64, 591-3(1925); cf. preceding abstr.—L. expresses regret at having overlooked B.'s paper. B. used few compds.; L. used many. All substances giving the reaction had their reactivity destroyed by treatment with alkali and acidification. I. GREENWALD

Iron in nutrition. I. Nutritional anemia on whole milk diets and the utilization of inorganic iron in hemoglobin building. E. B. HART, H. STEENBOCK, C. A. ELVEHJEM AND J. WADDELL. *J. Biol. Chem.* 65, 67-80(1925).—Rabbits limited to a diet of milk + 3 g. Na citrate per l. develop an anemia. Growth is apparently normal until the hemoglobin content and red cell fall to about 50% of the normal. The addn. of ferric salts does not correct this deficiency but, if cabbage or the EtOH ext. of desiccated cabbage or of yellow corn meal or 25 mg. purified chlorophyll (free from Fe) be added, together with the Fe_2O_3 , the anemia does not develop. It is suggested that the vitamin E of Evans and Bishop (*C. A.* 17, 1045, 3699) and of Sure (*C. A.* 18, 1849) may be identical with the substances needed for hemoglobin formation. I. GREENWALD

The metabolism of sulfur. IX. The effect of repeated administration of small amounts of cystine. H. B. LEWIS. *J. Biol. Chem.* 65, 187-95(1925); cf. *C. A.* 18, 2189; 19, 2842.—Cystine has been administered orally as the Na salt in doses of 0.5-1.0 g. per kg. for successive days to fasting rabbits and to rabbits on a diet of oats and

cabbage. Protein and casts appeared in the urine, the excretions of non-protein N and creatinine were depressed, but no marked loss in cystine as evidenced by detn. of the cystine and amino-acid N content of the urine was observed. The blood showed a marked rise in the non-protein N. The 'neutral S' fraction of the urine was increased but the rise was not on account of the presence of cystine, nor of S_2O_3 . I. G.

Studies on experimental rickets. XXVI. A diet composed principally of purified foodstuffs for use with the "line test" for vitamin D studies. E. V. McCOLLUM, NINA SIMMONDS, J. ERNESTINE BECKER AND P. G. SHIPLEY. *J. Biol. Chem.* **65**, 97-100 (1925); cf. *C. A.* **18**, 1520.—The diet previously employed for the production of rickets (yellow maize 33, wheat 33, gelatin 15, wheat gluten 15, NaCl 1.0 and CaCO_3 3.0) will not regularly produce rickets if *hard* wheat is used. Four new diets recommended are: (4025) wheat germ 5.00, salt mixt. 37 5.15, CaCO_3 1.50, gelatin 10.00, egg albumin 10.00, wheat gluten 12.00, agar-agar 2.00, dextrin 49.35, butterfat 5.00 g.; (4026) wheat germ 5.0, salt mixt. 38 4.3, CaCO_3 1.5, casein 20.0, gelatin 5.0, wheat gluten 5.0, agar-agar 2.0, dextrin 52.2, butterfat 5.0 g.; (4033) and (4034) are the same as 4025 and 4026, resp., but with wheat germ replaced by yeast. Salt mixt. 37 contains CaCO_3 1.50, KCl 1.00, NaCl 1.00, NaHCO_3 0.40, MgO 0.20, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ 0.20, KH_2PO_4 0.85 and salt mixt. 38 is the same with the omission of the KH_2PO_4 . Diets 4025, 4026 and 4034 produce rickets in 25 days and diet 4033 produces rickets in from 35 to 40 days. I. GREENWALD

A possible relationship of arachidonic acid to the saturated fatty acids in fatty acid metabolism. L. G. WESSON. *J. Biol. Chem.* **65**, 235-50 (1925).—From 50 to 100 g. of the hashed tissue are extd. 3 times for 24 hrs. at room temp., with sufficient 95% EtOH to cover the sample. Six extns. with Et₂O during 3 days follow. The combined exts. are shaken with an equal vol. of 0.5 satd. NaCl contg. 20 cc. 10% HCl per l. The H₂O layer is extd. with Et₂O and the combined EtOH-Et₂O exts. are evapd. *in vacuo*, and finally dried in a tared flask. After weighing, the residue is dissolved in abs. Et₂O. Br₂, carried in a stream of CO₂, is projected onto the surface of the cold Et₂O soln. until this is a deep red. After standing 2 days, the ppt. is collected in a small, tared centrifuge tube, washed with Et₂O and EtOH and then digested with concd. HCl at 40° overnight. It is then washed with H₂O, EtOH and Et₂O and finally dried at 100°. Wt. $\times 0.3225$ = arachidonic acid. For rats in good condition the amt of arachidonic acid per g. of moist tissue was about 0.75 mg. After feeding cod-liver oil, rich in arachidonic acid, for a considerable period, this value rose to 2 or 3 mg. Complete deprivation of all fats, and even of all Et₂O-sol. substances, made little difference, the value falling to about 0.65 mg. When the rats were starved, however, the amt. of arachidonic acid increased to 0.9 to 3.12 mg. per g. tissue during the stages in which body fat was available only to fall again when the store of fat was depleted. The same increase was observed in phlorhizinized rats and in those in which beri-beri had been induced. The livers contained more arachidonic acid per g. tissue and more per g. Et₂O ext. than did the rest of the rat carcass. Arachidonic acid was found in dog liver 0.18, pancreas 0.10, kidney 0.11, lung 0.05, spleen 0.06, lymph glands 0.02, heart muscle 0.01, temporal muscle 0.02%. It is suggested that arachidonic acid is an intermediate product in the metabolism of at least part of the fatty acids which contain fewer than 20 C atoms. I. GREENWALD

The effect of the bacterial flora on the biological test for vitamin B. V. G. HELLER, C. H. McELROY AND BERTHA GARLOCK. *J. Biol. Chem.* **65**, 255-64 (1925).—Rats kept under the usual lab. conditions (access to own feces) did not respond as rapidly to a ration deficient in vitamin B as did those kept on screens. The diet consisted of dextrin 76.3, casein 15.0, butterfat 5.0, salt mixt. 3.7% (McCollum's No. 185, *C. A.* **8**, 3673). The feeding of feces to animals whose growth had ceased was followed by a resumption of growth. Spore-forming organisms isolated from rat feces formed vitamin B when grown in a medium consisting of beef ext. 0.3, Difco peptone 0.5, NaCl 0.1, glycerol 4.5 g. and H₂O 100 cc. A similar synthesis is supposed to occur in the intestine. Animals given roughage of some form make better growth than those without it. This is particularly true of agar-agar but is not due to the introduction of vitamin B with the roughage. I. GREENWALD

Influence of small quantities of potassium iodide on the assimilation of nitrogen, phosphorus and calcium in the growing pig. F. C. KELLY. *Biochem. J.* **19**, 559-68 (1925).—Male pigs from 2 to 4 months old were used. The methods used were those described by Husband, Godden and Richards (*C. A.* **18**, 850). Small quantities of I (as KI), added to the cereal rations used, led to an increased assimilation and retention of N and P. There was also some evidence, but less marked, of an increased retention of Ca. B. H.

Effect of ultra-violet light on the mineral metabolism of the lactating animal.

J. B. ORR, H. E. MAGEE AND J. M. HENDERSON. *Biochem. J.* 19, 569-72(1925).—The work confirms that of Hart, Steenbock and Elvehjem (*C. A.* 19, 669) in which it was shown that ultra-violet rays may convert negative balances of Ca and P in the lactating goat to positive balances. The result may be accounted for by a decreased excretion of Ca from the feces, the urinary excretion remaining practically const. Irradiation may, therefore, cause an increased absorption of Ca from the intestine.

BENJAMIN HARROW

Bicarbonate of the plasma and the hydrogen-ion concentration of the blood of guinea pigs suffering from scurvy. E. H. LEPPER AND S. S. ZILVA. *Biochem. J.* 19, 581-8(1925).—There are large variations in the amt. of bicarbonate in the plasma of normal guinea pigs; the H-ion concn., on the other hand, shows only slight variations. The titratable alkali of guinea pigs suffering from scurvy is on the av. at a lower level than that of normal guinea pigs. This is due to the deficiency of Na and K salts of org. acids in the scurvy-producing diet. The addn. of Na citrate to the diet restores the normal bicarbonate content of the plasma but does not influence the onset of scurvy.

BENJAMIN HARROW

The anti-scorbutic fraction of lemon juice. III. S. S. ZILVA. *Biochem. J.* 19, 589-94(1925); cf. *C. A.* 18, 3411.— $\text{Pb}(\text{OAc})_2$ does not ppt. the antiscorbutic factor from lemon juice or swede juice, whereas basic Pb acetate ppts. it quant. There is no connection between the amide N and the antiscorbutic activity of lemon juice. B. H.

Energy metabolism of premature and undersized infants. M. E. MARSH AND J. R. MURLIN. *Am. J. Diseases Children* 30, 310-20(1925).—Energy metabolism has been detd. in 82 observational periods on 21 premature and undersized infants, including 5 pairs of twins. The av. basal respiratory quotient was low (0.74) through the fifth day, rose to 0.79 on the sixth day but never above this figure through the ninth day; whereas the quotient for a child in good nutritive condition, at least after the first week, should be about 0.85. The basal metabolism of these 21 infants averages 6.48 cal. per hr. or 26.25 cal. per sq. m. and 2.04 cal. per kg. per hr. Increases in heat production with activity varied from 2.5% with slight restlessness to 40.3% when the child cried 39.0% of the time.

I. N. K.

The nitrogen and mineral balances in infants receiving cow and goat milk. AMY L. DANIELS AND G. STEARNS. *Am. J. Diseases Children* 20, 359-66(1925).—The urinary phosphorus in all infants receiving goat milk were higher than those during the periods when they were receiving cow milk. The Ca and P balances during the goat milk periods did not indicate that the inorg. moiety of the goat milk was superior to cow milk. Nor did the ratio of P to Ca retained in infants receiving goat milk suggest that this is better than cow milk. On goat milk all infants retained considerably less N than during the corresponding period, when they were receiving cow milk.

I. N. K.

The oxidation of vitamin A in milk fat by churning. J. B. PLATON. *Biochem. Z.* 155, 228-34(1925).—Butter was made from pasteurized cream both in the presence of air, and in the presence of CO_2 . Each butter was then assayed with young rats for its vitamin A content. No difference between the butters could be detected. Therefore, no appreciable destruction of vitamin A occurs by oxidation in churning milk fat.

W. D. LANGLEY

The influence of ultraviolet light upon accessory food substances. S. S. ZILVA. *Biochem. Z.* 155, 333(1925).—Z. informs Spinka (cf. *C. A.* 19, 2364) that irradiation of butter with ultra-violet light had been reported in 1919 (cf. *C. A.* 13, 2886). In Z.'s work, however, the irradiated butter did not contain substances toxic to the rats, as they lived as long as 4 weeks.

W. D. LANGLEY

The constancy of basal metabolism in the normal dog. L. HÉDON. *Compt. rend. soc. biol.* 93, 150-2(1925).—On the av. the basal metabolism of normal dogs is 2.5 cal. per kg.-hr., or 34 cal. per hr. and sq. m.

S. MORGULIS

Influence of inanition and of the ingestion of sucrose on the urea of the blood. GEORGE FONTJES AND ALEXANDRE YOVANOVITCH. *Compt. rend. soc. biol.* 93, 690-1(1925).—The blood urea rises in the course of inanition, but when sucrose is given at an advanced stage in the inanition there is a quick drop in the blood urea back to the normal level.

S. MORGULIS

Stimulating effects of vitamin preparations on growth. KRIZNECKY AND J. PODHRADSKY. *Rev. zootechnie* 4, 31-6(1925); *Rev. internat. renseign. agr.* 3, 594-5(1925).—Expts. with mice, rabbits and pullets and young cocks fed with normal diets to which was added vitamin preps. clearly showed a stimulating action of the latter on growth.

A. PAPINEAU-COUTURE

2186. Elementary equilibrium and relative proportions of mineral salts and of carbohydrates 1.0 g. tion. (MME.) L. RANDOIN, J. ALQUIER AND MILES. ASSELIN AND CHARLES.

Compt. rend. **180**, 2063-5(1925); cf. *C. A.* **18**, 1140, 1322, 2023.—Rats were fed rations consisting of coarse bran with casein or butter, to which was added either sucrose or the salts ($\text{NaCl} + \text{CaCl}_2$). The growth of the animals was observed by daily weighing and the energy value of the ration was estd. by detn. of the coeff. of digestibility. The data detd. were energy value, ratio Ca/P , ratio of total minerals to total carbohydrates (cellulose excepted) and the ratio of the total minerals in the sol. part to the sol. carbohydrates. The results proved that a mixt. of bran and casein or of bran and butter gave a growth nearly equal to that by a ration contg. the added salts and a part of the bran and butter replaced by sugar. A disequil. caused by the addn. singly of salts or sugar affected the reproductive function rather than growth. The degree of growth follows the ratio of the minerals to the carbohydrates, the optimum ratio being within the limits 1/7.7 and 1/9.7. The importance of further study of this ratio is emphasized. L. W. RIGGS

Sugar content of the blood in runners following a marathon race, with especial reference to the prevention of hypoglycemia: further observations. BURGESS GORDON, L. A. KOHN, S. A. LEVINE, MARCEL MATTON, W. DEM. SCRIVER and W. B. WHITING. *J. Am. Med. Assoc.* **85**, 508-9(1925); cf. *C. A.* **18**, 2558.—Data with reference to the runners of the 1924 and 1925 races are placed in 1 table for comparison. Marathon runners who competed in the race of 1924 and showed blood sugar levels below normal were placed on a moderately high carbohydrate diet during the 1925 training season, and were advised to take a large amt. of carbohydrate 24 hrs. before the race. Another group of runners who developed symptoms of weakness and hunger in the 1924 race were studied during the 1925 training to det. at what stage of the 25 mile run these symptoms were likely to develop. It was found that these symptoms were apt to occur between the 14th and 18th miles. Therefore, in addn. to the diet recommended before the race, these athletes were supplied with glucose candies to be eaten from time to time while running. In addn. they were supplied with highly sweetened tea at stations along the course. The blood studies showed normal sugar levels in all runners, in contrast to the low figures obtained in 1924. There was also a striking improvement in their general phys. condition. L. W. RIGGS

Nutritional study upon a fungus enzyme. G. W. HERVEY. *Science* **62**, 247 (1925).—"A vegetable fungus enzymic material called protozyme" was fed to 4 groups of chicks at the rate of 1, 2, 3 and 5% of their mash rations. There were 100 chicks in each of the 4 groups and 95 in a fifth control group. During 20 weeks feeding, in every instance the chicks consuming the enzymic material made a more rapid gain of wt. than the control chicks. Also the gain was proportional to the amt. of enzymic material eaten. Tests upon the contents of the crop and gizzard at the end of the 6th week of age indicated increased starch and protein digestion in chicks consuming enzymic material over those not consuming it. L. W. RIGGS

Studies in iodine feeding. I. Potassium iodide feeding beneficial to young swine. J. M. EVVARD and C. C. CULBERTSON. Iowa Agr. Expt. Sta. *Res. Bull.* **80**, 183-219(1925).—The feeding of KI to young swine in dry lot and on rape pasture resulted, in 3 sep. expts. in 3 years, in increasing the av. daily gain approx. 10% and likewise in decreasing by 10% the feed required for 100 lbs. of gain. KI 0.1 lb. was mixed with 1000 lb. of supplemental protein, vitamin and mineral feed mixture, in the 1st expts.; 0.1 lb. in 100 lbs. feed in the 2nd expts., and 0.5 lb. per 100 lb. in the 3rd expt. J. J. SKINNER

Motor and secretory functions of the small intestine during hunger. E. I. SINELNIKOV. *Arch. ges. Physiol.* (Pfüger's) **208**, 684-93(1925).—In the periodic activity of the small intestine there is a true relationship between peristalsis and secretion; in the healthy animal there is a parallelism which involves not only the no. of contractions but also their strength and the tonus. The cause of the periodic activity must reside in a hormone of unknown chem. nature.

F—PHYSIOLOGY

ANDREW HUNTER

Proteolytic liver enzymes. L. UTKIN-LIUBOVZOV. *Biochem. Z.* **158**, 50-64 (1925).—Evidence is presented that there are 3 proteolytic enzymes in the liver. When proteins are pptd. from suspensions of liver by acidifying to p_H 4.7-5.0, proteolytic enzymes are found with the pptd. proteins and in the filtrate. Casein digestion by the filtrate shows 2 maxima at p_H 5.2-5.4 and p_H 3.0-3.4. Casein is digested by the enzymes pptd. with the liver proteins at a p_H of 7.5-7.6. F. A. CAJORI

The source of energy in muscle work. O. MEYERHOF. *Biochem. Z.* **158**, 218-22 (1925).—Answer to Lusk (cf. *C. A.* **19**, 2695). F. A. CAJORI

The significance of acetaldehyde formation in frog muscle and its numerical relation during respiration. C. NEUBERG AND A. GOTTSCHALK. *Biochem. Z.* 158, 253-6 (1925).—A quant. relationship exists between the quantity of carbohydrate oxidized in chopped frog muscle and the CH_3CHO produced. The CH_3CHO bound by CaSO_4 in muscle suspensions is 37 to 45% of the carbohydrate oxidized. CH_3CHO is an intermediary product in carbohydrate oxidation in frog muscle. F. A. CAJORI

Comparative studies of the amino nitrogen content of the urine in human beings after administration of glycocoll and gelatin. R. W. SEUFFERT AND ERICH VOIGT. *Beitr. Physiol.* 2, 257-62 (1924); *Chem. Zentr.* 1925, 1, 981-2.—After administration of approx. equiv. amts. of glycocoll as such (up to 10 g. daily) or in the form of gelatin, the ratio between the N in the urine and the assimilated N indicated a very unfavorable condition in regard to the utilization of amino acids. When the doses of glycocoll exceeded 10 g., the elimination of amino N increased greatly. C. C. DAVIS

The phosphatide and the total phosphorus content of human and of cow milk. A. F. HESS AND F. DOROTHY HELMAN. *J. Biol. Chem.* 64, 781-96 (1925).—By Bloss's method (*C. A.* 9, 2912) for the extn. of the lipoids and a modification of Tisdall's method (*C. A.* 16, 1444) for the detn. of P in the oxidized material, cow milk was found to contain 5.3-5.6 mg. lipid P and 76-82 mg. total P per 100 cc. Skimmed milk, contg. 0.4% fat, contained 4.1-4.4 mg. lipid P and 96-109 mg. total P. Two samples of cream, of 20 and 32% fat content, contained 7.1 and 10.2 mg. lipid P, resp., and 65 mg. total P. Colostrum contained about 100 mg. total P and 11 mg. lipid P. Human milk contained 1.5-4.1 mg. lipid P and 8.2-24.4 mg. total P. (A higher degree of variability in the milk obtained within the first 2 weeks of lactation than that obtained later is claimed but the results appear to be due to the fact that the former were individual samples and the latter, chiefly composites. Abstr.) Two samples of goat milk contained 6% fat, 103 and 133 mg. total P and 5.4 and 3.0 mg. lipid P. Two samples of ass milk contained 3 and 1% fat, 73 and 60 mg. total P and 7.2 and 2.4 mg. lipid P. The $\text{EtOH-Et}_2\text{O}$ ext. of cow milk was evapd. *in vacuo*, dried over H_2SO_4 , and extd. with ligroin. The ext. contained 0.9 mg. P per 100 cc. milk. The residue was extd. with $\text{EtOH-Et}_2\text{O}$ (3:1); 1.56 mg. P was dissolved. The residue contained 0.78 mg. P, a total of 3.24 mg. A direct detn. yielded 3.44 mg. I. GREENWALD

The fatty acids in the subcutaneous fat of man. H. C. ECKSTEIN. *J. Biol. Chem.* 64, 797-806 (1925).—The subcutaneous fat from the abdomen of a woman contained 0.37% non-saponifiable matter, 64% unsatd. fatty acids and 27% satd. fatty acids. 0.5% linoleic acid was isolated but larger quantities were probably present. About 0.03% of an acid with 3 double bonds and 0.33% of one with four double bonds were also indicated. The fat also seems to contain about 1% myristic acid and traces of lauric acid. The digitonin method showed the presence of 0.24% cholesterol. I. G.

An extract obtained from the external bovine parathyroid glands capable of inducing hypercalcemia in normal and thyreoprivic dogs. A. M. HJORT, S. C. ROBISON AND F. H. TENDICK. *J. Biol. Chem.* 65, 117-28 (1925); cf. *C. A.* 19, 2076, 2520.—A $\text{H}_2\text{O-HCl}$ or EtOH-HCl ext. of bovine parathyroids administered parenterally to dogs relieves tetany (following parathyroidectomy) and produces hypercalcemia in both normal and parathyroidectomized animals. Boiling with 0.1 N HCl gives better results than extn. at room temp. Glands previously extd. with AcMe and CHCl_3 give active exts. Very little, if any, potency is lost in the removal of proteins by neutralization to the isoelec point and addn. of EtOH to concn. of 80%. Exts. retained their activity for 16 months in the ice chest. I. GREENWALD

The loss of bases in diuresis and its effect on the alkali reserve of the blood. B. M. HENDRIX AND D. B. CALVIN. *J. Biol. Chem.* 65, 197-214 (1925).—In diuresis due to the injection of NaNO_3 , NaCl , Na_2SO_4 or of urea in dogs there was an increased loss of base in the urine. This was accompanied by a marked fall in the HCO_3^- -ion content of the blood. The effect of NaNO_3 was transient; that of NaCl was more prolonged. The effect is believed to be due to a failure of reabsorption from the tubules, due to their being flooded. I. GREENWALD

Studies of the metabolism of women. I. Variations in the fasting blood sugar level and in sugar tolerance in relation to the menstrual cycle. RUTH OKEY AND ELDA I. ROBB. *J. Biol. Chem.* 65, 165-86 (1925).—"On the basis of a total of more than 300 detns. of "before breakfast" blood sugar (Folin-Wu method, *C. A.* 17, 2353), covering 49 menstrual periods in 26 normal women, there seems to be no ground for conclusion that there is a consistent cyclic variation in the fasting blood sugar level in women. The av. values observed during menstruation are slightly higher than those for the intermenstrual period. However, there are a greater no. not only of high values, but also of low values, during the menstrual period than at any other time, . . . The inges-

tion of 1.75 g. of glucose per kg. body wt. has, however, led in the 10 cases observed, not only to smaller initial increases in blood sugar, but also to a greater degree of secondary hyperglucemia during the menstrual period than at any other time of the month. The effect noted immediately before and after this time is just the opposite, *i. e.* a lessened tolerance."

The maintenance of carbonic acid equilibrium in the body, with especial reference to the influence of respiration and kidney function on CO_2 , H^+ , HCO_3^- and CO_3^{--} concentrations in plasma. C. D. MURRAY AND A. BAIRD HASTINGS. *J. Biol. Chem.* 65, 265-78 (1925).—The constancy of the CO_2 -ion concn. of plasma during an arterial-venous cycle has been shown and the unique fitness of the blood for the maintenance of this constancy has been demonstrated. A nomogram embodying the variables CO_2 and the ions HCO_3^- , H^+ , CO_3^{--} , Ca , PO_4 , HPO_4 and H_2PO_4 has been described. A consideration of the changes occurring in blood during an arterial-venous cycle leads to the hypothesis of respiratory control by CO_2 tension. Considered from the point of view of the nomogram, respiration causes change of plasma along a line practically parallel to a const. CO_2 -ion line, while kidney function results in change of plasma parallel to a const. CO_2 tension line.

Changes in conductivity of fed cell suspensions during hemolysis. I. GREENWALD AND W. W. TAYLOR. *Biochem. J.* 19, 552-8 (1925).—The liberation of electrolyte from red cells during hemolysis by water is such as may be explained by each cell giving up the electrolyte contained in it, liberation of electrolyte being proportional to the percentage no. of cells hemolyzed, and complete when hemolysis is complete. In the case of complement-amboceptor hemolysis, the full amt. of electrolyte does not appear to be liberated. This is due to some of the electrolyte passing out of the cells combined with hemoglobin from which it can be split off by the addn. of saponin and also, to some extent, by heating.

Effects of parathyroid feeding on calcium and creatine metabolism. BENJAMIN HARROW AND DOROTHY WOODMAN. *Biochem. J.* 19, 595-600 (1925).—Parathyroid feeding and injections have no effect on the deposition of Ca in bone; but parathyroid feeding causes an alteration in the ratio of creatinine to creatine excreted, resulting in the elimination of more creatine and less creatinine.

Suprarenal cortex and skeletal growth. Histological, radiographic and chemical studies on the guinea pig. L. CASTALDI AND M. AIAZZI MANCINI. *Rend. d. advance d. Accad. med.-fis. fiorentina; Sperimentale* 79, 587-91 (1925).—Oral administration results in a stimulation of bone-growth, especially in length, without change in compn. M. H.

Capillary "contractility." M. VOLTERRA. *Rend. d. advance d. Accad. med.-fis. fiorentina; Sperimentale* 79, 618-42 (1925).—The changes observed are phys.-chem. with respect to the connecting reticular tissue and result from chem. changes in the tissues and circulating blood.

The relation between splitting reactions and respiration in the cell. OTTO MEYERHOF. *Ber.* 58B, 991-1001 (1925); cf. 17, 3532; 18, 1522.—Splitting metabolism in the muscle is an anaerobic process and is reversed by respiration. This was established by detn. of O , CO_2 and carbohydrate. The energy required for the restoration of carbohydrate is furnished by the combustion of a relatively small part of carbohydrate or lactic acid. It is more probable that the entire lactic acid is converted into glycogen and that respiration takes place at the expense of carbohydrate. In the contracting muscle the oxidation quotient of lactic acid: removed lactic acid/oxidized lactic acid, is 4-5. This chemically detd. quotient agrees well with that found calorimetrically by Hill. The heat developed in the phase of anaerobic contraction represents the energy of the exothermic splitting process, while the heat liberated in the recovery period is the excess of the oxidation heat over the endothermic re-synthesis of glycogen. The quotient as well as the amt. of heat varies with the condition of the muscle, showing that the process is based on an energetic relation rather than on a purely chem. oxidation-re-synthesis cycle. The oxidation quotient in the resting muscle is the same as that during exercise. Respiration is controlled by the lactate ion, and increases with the concn. of the latter as is demonstrated by expts. with minced muscle and with lactate solns. Pyruvic acid reacts similarly. It was shown by Warburg that this cycle occurs in all tissues of warm-blooded animals although with a varying oxidation coeff. O plays the same role in lactic acid fermentation caused by widely different organisms and in alc. fermentation. Each mol. of oxidized sugar protects 6 mols. sugar from fermentation. There are characteristic differences between the yeasts: The respiration of pressed top yeast is 6-8 times higher in sugar than in sugar-free solns., and the fermentation is reduced to $1/3$ in O ; addn. of HCN , which depresses respiration but hardly affects fermentation in 0.001N soln. increases the fermentation in O 2-3 times. Brewer's

bottom yeast is independent of these factors, while brewer's top yeast occupies a middle position. There are proofs that pyruvic acid plays in alc. fermentation the same role as lactic acid in glucolysis. The role of splitting processes as a direct source of energy not only for mech. work, but most probably also for cell growth and presumably for the reactions in the nerve organs, seems to be established. Respiration thus appears as an economy device, intended to check and reverse the cleavage processes as soon as they have furnished the amt. of energy required. MARY JACOBSEN

The composition of amniotic fluid [of the cow]. H. REINWEIN AND H. HEINLEIN. *Z. Biol.* **81**, 283-90 (1924).—The residue after evapn. of the trichloroethylene ext. was treated with alc. The alc. was freed from solvent. Treatment with ligroin gave a sol. fraction (benzoic acid) and an insol. fraction (hippuric acid). No purine bases were obtained. Histidine was isolated as the picolonate, $C_8H_5N_3O_2 \cdot C_{10}H_7N_3O_6$, m. 205° ; guanidine as the chloroaurate, $C_2H_7N_3 \cdot HAuCl_4$, m. 198-202 and a base, $C_{13}H_{30}N_2O_4$, isomeric with the tetanine of Brieger. FRANCES KRASNOW

Investigations of blood clotting. X. The detection of the so-called thrombin in oxalated plasma. B. STUBER AND S. LEE. *Biochem. Z.* **150**, 543-7 (1924), cf. *C. A.* **16**, 1609.—In oxalated plasma there occurs an active thrombin after removal by dialysis of the added oxalate. This proves the artificial nature of thrombin and shows the difference between the mechanism of its action and that of native serum. W. D. L.

Blood sugar curves after intravenous injection of α -, β - and α , β -glucose in rabbits. F. LIPMANN AND J. P. PLANELLES. *Biochem. Z.* **151**, 98-102 (1924).—The level of blood sugar after α , β -glucose was injected into rabbits remained higher than that from α - or β -glucose alone, while the values after the injection of β -glucose were higher than those after α -glucose. W. D. LANGLEY

The carbon dioxide content of capillary blood and its determination. F. VERZAR AND B. VÁSÁRHELYI. *Biochem. Z.* **151**, 246-53 (1924).—The normal values for CO_2 in capillary blood ranged from 40.8 to 62.3 vol., the av. being 49.8 vol. %. The value is quite const. for one and the same person. After stair running, the CO_2 content may drop as much as 35 vol. %. The Barcroft differential app. is so modified that no correction factor need be used. W. D. LANGLEY

The hormonal regulation of intermediary carbohydrate metabolism. I. Importance of adrenaline and insulin in the utilization of dextrose by warm-blooded animals. A. GOTTSCHALK. *Biochem. Z.* **155**, 348-55 (1925).—See *C. A.* **19**, 347. W. D. L.

Intermediary carbohydrate metabolism. VIII. Phosphatase and phosphatase and hexosediphosphoric acid in the liver with regard to insulin. TH. BRUGSCH AND H. HORSTERS. *Biochem. Z.* **155**, 459-76 (1925); cf. *C. A.* **19**, 2232, 2243.—Liver contains a phosphatase which splits hexosediphosphoric acid into *d*-fructose and H_2PO_4 , to the extent of 47% in about 2.5 hrs. The liver of a depancreatized dog, however, is able to split the acid only about $1/2$ as rapidly. The increase in lactic acid could not be accounted for by the hexosediphosphoric acid which disappeared. Insulin does not affect the action of the enzyme, but the rotation of the sugar soln. decreases. Thyroidectomy increases the action of the phosphatase. That enzyme which synthesizes hexosediphosphoric acid from its components is called *phosphatase*. The active principle of insulin is a kinase which activates phosphatase. The kinase is relatively heat stable ($to 93^\circ$) and acts both *in vivo* and *in vitro*. W. D. LANGLEY

Iodine content of the thyroid of the tatou. J. CHEYMOL AND R. GLEY. *Compt. rend. soc. biol.* **92**, 1348 (1925).—The thyroid of the Brazilian tatou (*Tatusia norevinctia*) contains 2.41 mg. I per g. of dry substance. Iodine content of the thyroid and of the blood of guinea pigs. *Ibid* 1348-9.—The I_2 content of the thyroid gland is 0.080-0.154 g. per 100 g. of dry tissue. The blood contains 0.11-0.13 mg. per l. S. M.

The constant iron content per unit weight in fetuses of full term in the same litter. GEORGES FOMÈS AND LUCIEN THIVOLLE. *Compt. rend. soc. biol.* **93**, 266-7 (1925).—The av. Fe content per 100 g. of rabbit fetus was 7.37 mg.; the extreme variations in a set of 6 fetuses were 7.2-7.9 mg. S. MORGULIS

Oxygen content of methemoglobin: methemoglobin in solution and methemoglobin in the cell. MAURICE NICLOUX AND JEAN ROCHE. *Compt. rend. soc. biol.* **93**, 275-8 (1925).—Methemoglobin contains part of the O of oxyhemoglobin. S. MORGULIS

Effects of injections of extracts of the follicular fluid into immature females. L. BROUHA AND H. SIMONNET. *Compt. rend. soc. biol.* **93**, 489-94 (1925).—Confirmation of the results of other observers that exts. from follicular fluid when injected into immature females produces the estrous cycle without, however, affecting the ovary or the mammary glands otherwise. Successive injections produce a greater response and also affect the development of the uterus much more than a single injection. S. MORGULIS

Studies of blood calcium. Effect on the blood calcium of passage through the lungs. Asphyxial hypercalcemia. LÉON BINET AND AL. BLANCHETIERRE. *Compt. rend. soc. biol.* 93, 511-2(1925).—Venous blood is always richer in Ca than arterial blood; asphyxia is accompanied by a rise in the Ca of the blood. S. MORGULIS

The cycle of fats in the organism. A. GRIGAUT AND J. DEJACE. *Compt. rend. soc. biol.* 93, 586-9(1925). S. MORGULIS

Increase in weight of the body caused by humors and extracts of organs from fat animals. P. CARNOT AND E. TERRIS. *Compt. rend. soc. biol.* 93, 606-8(1925).—There is a rapid increase in the wt. of rabbits as well as of human patients on a fixed diet when they are treated with subcutaneous injections of deproteinized exts. of organs obtained from fattened animals. S. MORGULIS

Hydrogen-ion concentrations of the pancreatic juice. C. DUBOIS AND MICHEL POLONOVSKI. *Compt. rend. soc. biol.* 93, 632-3(1925).—The p_H of the pancreatic juice obtained after the injection of various alkaloids (eserine, pilocarpine) is lower than that obtained with secretin. S. MORGULIS

Variations in the total iron content of an animal during the period of suckling. GEORGES FONTÈS AND LUCIEN THIVOLLE. *Compt. rend. soc. biol.* 93, 681-3(1925).—In the rabbit and cat the Fe content remains unchanged during the entire period of suckling, but in the dog the Fe content increases 100% in the first 30 days of life, and this Fe must be furnished by the mother's milk. Dog milk contains 6.4 mg. per l. S. MORGULIS

The production of volatile fatty acids in the intestinal tract of calves fed whole milk or cereal gruel. L. C. NORRIS. Cornell Agr. Expt. Sta., *Memoir* 90, 32 pp.(1925).—Acetic and propionic acids were found in the feces of growing calves in an approx. 1:1 ratio. No other acids of the fatty acid series were revealed by qual. test, although there were slight indications of the presence of butyric acid. Ethyl alcohol was present in large quantities in the feces, but propyl alc. was identified in only 2 instances and then in only very small amts. The presence of esters was not proved. The calves which received a cereal-gruel diet excreted daily a much larger quantity of acid and alc. than the one which received a whole-milk diet. The presence of such large quantities of acid and alcohol in the feces of calves fed a cereal-gruel diet indicates that young calves do not have the power completely to digest large amts. of carbohydrates consisting essentially of starches. Therefore the partially digested food residues are acted upon by bacteria, resulting in the production of acids and alcohols. J. J. S.

Concentration of alcohol in the blood and excretion at high altitudes. WILH. BIEHLER. *Arch. expil. Path. Pharm.* 107, 20-42(1925).—The alc. curves in the blood of rabbits were detd. at sea level, at 1500 m., and at 2500 m., after the administration of doses varying from 0.9 to 3 cc. of abs. alc. per kg. of body wt. With the same dosage the concn. of alc. in the blood reaches its max. more slowly and attains a max. of lower value as the altitude is increased. This shift in the concn. curve is referable to the altered rate of elimination through the respiratory tract. G. H. S.

Ion antagonism in invertase-protein and invertase-lecithin systems. A. SCHÜRMEYER. *Arch. ges. Physiol.* (Pfüger's) 208, 595-603(1925).—The splitting of sucrose by invertase prepd. according to the method of Michaelis is inhibited by the addn. of salts, the inhibitory effect increasing as the salt content is augmented. Salts with bivalent cations are more effective than those with univalent ions. With Na and Ca combined in the proportion of 1 Na:1/20 Ca the inhibitive action largely disappears. Protein-free invertase does not show any salt susceptibility to either uni- or bi-valent cations, but by the addn. of such substances as lecithin, gelatin, albumin, or globulin salt susceptibility is restored. Mixts. with gelatin and albumin show no ion antagonisms, but in lecithin and globulin mixts. a min. of inhibition occurs with 1 K:1/20 Mg or 1 Na:1/20 Ca. Phenylurea does not narcotize invertase when it is freed of protein, but this capacity to be narcotized is restored by the addn. of albumin, and especially of globulin. G. H. S.

Urine formation in the frog kidney. VII. Excretion of nonelectrolytes through the frog kidney. FRITZ WANKELL. *Arch. ges. Physiol.* (Pfüger's) 208, 604-16(1925).—The org. non-conducting substances show a marked difference in their behavior in the process of excretion through the kidney, in that N-contg. substances are excreted in a concd. form while carbohydrates are never concd. This difference might possibly be considered as referable to a difference between electrolytes and nonelectrolytes, especially if one assumes with Bjerrum that the amino acids are present in the soln. in ionic form. With glycocoll and alanine the behavior is detd. by the reaction, since in an acid medium both are concd., while in an alk. reaction there is not only no concn. but there may even be a diln. Aspartic acid and glutamic acid, like other amino acids,

are concl., while asparagine and glutamine pass through the kidney unchanged. These differences present many interesting questions as to the regulatory mechanism of the kidney in the excretion of the normal end products of metabolism. G. H. S.

Phlorhizin glucosuria. V. Effect of phlorhizin during nourishment with diets free of carbohydrate but containing abundant protein and fat. P. JUNKERSDORF AND RICHARD KUHN. *Arch. ges. Physiol.* (Pflüger's) 208, 617-37(1925); cf. C. A. 19, 2083 and following abstr.—Phlorhizin dogs show a characteristic hypoglycemia when upon a diet free of carbohydrate and rich in proteins and fats despite the fact that an abundance of material for glycogen formation is present. This result is not due solely to a renal condition but may be referred to a disturbance in the blood-sugar-regulating function of the liver cells, a disturbance caused by the abundance of fats in the food. The fatty infiltration of the liver is accompanied by a similar change in the kidney, thus inducing a functional disturbance of this organ. Apparently this infiltration is unattended by degenerative changes. The fat content of the heart is also higher than normal but the glycogen content remains within normal limits. G. H. S.

Phlorhizin glucosuria. VI. Hunger experiments with intercurrent administration of phlorhizin, with comparative histological and chemical study of the organs. P. JUNKERSDORF AND WERNER BICKENBACH. *Arch. ges. Physiol.* (Pflüger's) 208, 638-60 (1925); cf. preceding abstr.—Analyses of urine and organs showed that the individual variations in the blood sugar are related to the condition of the glycogen content of the animal at the beginning of the expt., to the length of the exptl. procedure, and in particular to the reserve fat deposits and the fatty infiltration of the liver associated with the administration of the phlorhizin. Histol. and chem. studies agree in revealing the glycogen content of the kidney. The "proglycogen" of Fichera of the protoplasm of epithelial cells of kidney and liver is nothing more than fat vacuoles. In general the glomeruli and convoluted tubules, the heart, and the pancreas were normal. The reticulo-endothelial cells of the liver, kidney and pancreas showed, in one instance, large amts. of glycogen in spite of the fact that there was a general maximal glycogen deficiency. Changes in the pigment metabolism were noted. G. H. S.

Humoral transfer of heart-nerve action. VIII. W. R. WITANOWSKI. *Arch. ges. Physiol.* (Pflüger's) 208, 694-704(1925).—Vagus substance dialyzes through a collodion membrane, is susceptible to alkali, non-susceptible to acid, may be dried without loss of activity at 40° and at 100° with but slight loss in potency. Vagus substance and accelerans substance when dried from an acid soln. dissolve quantitatively in alc., but are insol. in ether. The alc. ext. from resting periods of the heart gives a typical vagus action while the ext. prepd. from vagus stimulation periods is from 3 to 6 times more active. Exts. prepd. from heart muscle before and after vagal stimulation show a similar relationship. The alc. ext. of nerves, with or without ganglia, shows a vagus effect, frequently after atropinization an accelerans effect. The vagal action of exts. of the fluids, of the heart muscle, and of the nerves are not due to choline; while the activity of exts. of striated muscle is almost entirely referable to choline. G. H. S.

Physiology of the skin glands in frogs. I. Secretory and inhibitory nerves of the glands. E. N. SPERANSKAJA-STEPANOWA. *Arch. ges. Physiol.* (Pflüger's) 209, 1-21 (1925).—The glands are associated with the sympathetic system, both secretory and inhibitory fibers being present. Adrenuline injected into the dorsal lymph sac may cause a secretion in the hind legs or may cause a complete inhibition of secretory activity. **II. Role of the peripheral sympathetic neurones in the secretion of the glands.** *Ibid* 22-31.—Glands with intact peripheral sympathetic neurones react much more strongly to peripheral stimuli than do glands cut off from the corresponding centers. Section of the preganglionic fibers exerts no demonstrable effect upon the glandular response to stimulation with BaCl. G. H. S.

Effect of the size of the animal upon the oxidation velocity of surviving tissues. PAUL WELS. *Arch. ges. Physiol.* (Pflüger's) 209, 32-48(1925).—The oxidation velocity of surviving tissues from warm-blooded animals diminishes with the increasing size of the animal. The surviving tissues of young animals show a higher oxidation velocity than do those of adults. Tissues of birds show a higher velocity than tissues from mammals of the same size. It seems that associated with species there is a definite degree of energy exchange of the tissues which is independent of the nervous system. Furthermore the magnitude of this energy exchange is related to the developmental stage of the individual. G. H. S.

RICKEY, EDNA: The Thyroid Influence on the Behavior of the White Rat. Baltimore: The Williams & Wilkins Co. 76 pp.

G—PATHOLOGY

H. GIDEON WELLS

Metabolism in diseases of the liver. I. Carbohydrate metabolism in liver disease.

A. VON FÉJÉR AND G. HETÉNYI. *Z. ges. expil. Med.* 42, 670 (1924).—Under normal liver conditions, oral administration of dextrose or levulose results in increased consumption of O, a rise in the respiratory quotient, and slight hyperglucemia. In diseased conditions of the liver, there is no increased consumption of O, a delayed rise in the respiratory quotient, and a longer and more marked hyperglucemia. After administration of levulose, the respiratory quotient rises more slowly and does not reach unity. It is probable that in diseased livers the synthesis and fixation of glycogen are deranged and that a considerable part of the sugar passes through unchanged. Levulose is not directly oxidizable. It is more readily transformable than dextrose into glycogen.

B. C. A.

Influence of an experimental sensitization on allergy and the heteroallergies.

B. DUJARDIN AND M. DECAMPS. *Ann. bull. soc. roy. sci. med. nat.* 1924, 100–16.—This extensive study is devoted to the influence of a sensitization by means of horse serum (or other proteins) upon the reaction of the organism toward tuberculin, cow milk and similar substances. The result is summarized in the statement that not only a specific sensitivity is produced but also a no. of non-specific sensitivities (heteroallergies).

R. BEUTNER

Acidosis in pathology. LUCIEN DAUTREBANDE. *Ann. bull. soc. roy. sci. med. nat.*

1924, 123–49.—A review of recent work on the measurements of p_H and alkali reserve in pathological conditions. Localized acidosis or alkalosis is discussed especially.

R. BEUTNER

• **Some enzymes of the cerebrospinal fluid in pathological conditions.** S. DRAGANESCU AND A. LISSIEVICI-DRAGANESCU. *Biochem. Z.* 156, 460–70 (1925).—Amylase occurs with leucocytes in the cerebrospinal fluid of patients with nervous diseases, though there is no strict parallel between the leucocyte count and the amylase content. Peroxidase is related to the polynuclear cells present in the fluid. Catalase usually occurs with peroxidase. Antitrypsin is present and is related to the quantity of protein existing in the fluid.

R. A. C.

The character of the so-called complement. FELIX KLOPFSTOCK. *Deut. med. Wochschr.* 50, 1790–2 (1924); *Chem. Zentr.* 1925, I, 1503.—Complement action is connected with the colloidal state. Bacteriolysin and hemolysin are fermentative substances which depend for their activity not only upon a definite p_H value, but require a colloidal system with a definite particle size, elec. charge of the particles, surface tension, viscosity, etc. Like the activation of pepsin by HCl, bacteriolysin and hemolysin are activated by the colloidal system of the serum (complement serokinase). Some kind of fermentation of a colloidal complex is involved.

C. C. DAVIS

Proof of the presence of aromatic groups in blood, body fluids and tissues, from which the protein has been removed, by the precipitate in the xanthoproteic reaction. ERWIN BECHER. *Münch. med. Wochschr.* 71, 1677–8 (1924); *Chem. Zentr.* 1925, I, 691; cf. *C. A.* 19, 1452.—Aromatic groups can be identified with the aid of the xanthoproteic reaction in blood, body fluids and tissues after the proteins have been removed. Two groups can be distinguished by the reaction: (1) a fraction contg. N and insol. in Et_2O , comprising amino acids and higher protein decompn. products and (2) a fraction after hydrolysis contg. no N and sol. in Et_2O , comprising phenols, cresols and aromatic hydroxy acids. In kidney insufficiency both fractions increase in the blood, body fluids and tissues, especially the substances sol. in Et_2O after hydrolysis. In diseases of the liver and heart and in infections, the xanthoproteic reaction is more intense than normally. In blood from the dead a great increase of the aromatic groups is found, the Et_2O -sol. fraction increasing in the same way that it does in diseases of the liver.

C. C. D.

The lactic acid content of the blood. FRIEDR. VALENTIN. *Münch. med. Wochschr.* 72, 86–90; *Chem. Zentr.* 1925, I, 1620.—Exhaustive investigations were carried out on human beings and on rabbits, including both normal and pathological cases. In normal human blood, the lactic acid content showed no great variations, the mean value being 11.06 mg. %. In rabbit blood, however, great variations were found, both among different animals and in the same animal. It varied from 75 to 128 mg. %. An exclusively carbohydrate diet, with the accompanying fermentation processes in the intestine, influenced the lactic acid conen. In active muscular contraction of the arm by 2 men, an increase of 40 and 30%, resp., of the lactic acid of the blood (based on that during sleep) was found. In spastic contraction of the arm in 3 persons, an av. increase of 63% was found, compared with the normal arm. There was no increase

in the lactic acid content of the blood in epilepsy, but in pathological conditions involving dyspnea an increase could almost always be detected. In arteriosclerosis no increase of lactic acid in the blood was noted, but there was almost always an increase with carcinoma. Expts. on human beings under treatment with insulin allowed no general conclusion to be drawn in regard to changes in lactic acid, and even in diabetics, where the insulin had a pronounced effect on the blood sugar, no changes were observed.

C. C. DAVIS

Investigations of the hydrogen-ion concentration of bladder urine in connection with the problem of the elimination of acid and alkali in functional kidney diagnosis. G. v. PANNEWITZ. *Z. urol. Chirurg.* 15, 227-45 (1924); *Chem. Zentr.* 1925, I, 690-2.—To avoid the disturbing influences present in the Rehn test, a study was made of the influences on the value of p_{H} in the urine. The increase in p_{H} after eating was verified, a decrease occurring only after eating acid food or oats. Low values were found in achlorhydria of the gastric juice. In sleep acid urine is excreted and likewise after injection of morphine, scopolamine and papaverine. Alkaluria is found after administration of caffeine and digitalis and also in the nervous under psychological excitement and shortly before an attack of hysteria.

C. C. DAVIS

Chromogen of methylene blue in diagnosis. J. CUATRECASAS. *Rev. espan. Med. Cirugia* 7, 445-50 (1924); *Physiol. Abstracts* 10, 35-6.—The elimination of methylene blue by the kidney occurs along the same lines as reduction of bilirubin and urobilin. Methylene blue has a threshold of reduction, below which only its chromogen is eliminated. The reducing power increases as the kidney becomes less permeable. In nephritis with retention of urea nearly all the stain is eliminated in the form of chromogen, while with the retention of chlorides alone there is scanty elimination of chromogen with good output of the blue. This would seem to indicate impaired reducing power in the tissues.

H. G.

The potassium of striped muscles under normal and pathological conditions. S. M. NEUSCHLOSS AND R. A. TRELLES. *Rev. assoc. med. Arg., soc. biol.* 37, 93-107 (1924); *Physiol. Abstracts* 10, 19-20; cf. *C. A.* 18, 3211.—K is found in skeletal muscles in 3 quotas. The first can be identified by placing an isolated muscle in an isotonic soln. of NaCl into which K diffuses within 6 hrs. in quantities varying from case to case. The second quota is observed only in muscles under the influence of the nervous system, and can be obtained by perfusing them with a fluid free from K in the living animal. The quantity of K present in muscles under this condition is fixed, and corresponds to 0.39% for the pale muscles and 0.58% for the red muscles of rabbits, and 0.09% for the gastrocnemius of the toad. The third quota is found by denervating a given muscle and continuing the perfusion with the K-free fluid. With the pale muscles of the rabbit the quantity of K falls to 0.11%. During the muscular rigidity caused by tetanus toxin this amt. increases to 0.74%. An intimate relation appears to exist between K and muscle tonus.

H. G.

The reducing substances of the blood. ALMA HILLER, G. C. LINDER AND D. D. VAN SLYKE. *J. Biol. Chem.* 64, 625-38 (1925).—Incubation at 38°, which led to complete disappearance of added glucose, or fermentation with yeast, left normally a residue of reducing substance, which showed a reducing power for $\text{K}_3\text{Fe}(\text{CN})_6$ (Hagedorn-Jensen method) or for Cu^{++} (Folin-Wu method) equiv. to 0.01 to 0.03% glucose. In insulin shock, in rabbits, the fermentable sugar might be reduced to zero, without affecting the non-fermentable reducing substance. "Abnormally high reducing power was observed in the blood of 4 out of 5 cases of glomerulonephritis with high N retention. The substance causing the increased reducing power showed, when the blood was fermented or incubated, a behavior identical with that of glucose."

I. GREENWALD

Attempt at a surgical treatment of diabetes. G. MANSFELD. *Klin. Wochschr.* 3, 2378-80 (1924).—The original idea was to sever the pancreatic duct, thus blocking the external secretion of the pancreas which might intensify the internal secretion. This was not tried because of the probable deleterious effect, on food digestion, of eliminating the pancreatic enzyme. A ligature was passed beneath the pancreatic vein and artery in the head of the pancreas and the pancreas tied off, exclusive of the blood supply, at this point. In this way only a portion of the external secretion of the pancreas was blocked. Dogs that had been so treated were persistently hypoglycemic after the effects of the surgical shock had subsided; they also showed an enormously high sugar tolerance which indicates that the internal secretion of the pancreas is increased when the external secretion is blocked.

MILTON HANKE

The effect, on the blood sugar, of cutting the pancreatic duct. D. ALPERN AND S. LEITES. *Klin. Wochschr.* 4, 1551 (1925).—A complete corroboration of the work of Mansfeld (see above) independently obtained.

MILTON HANKE

Blood sugar and carcinoma. A. FOERSTER AND A. FORSTER. *Klin. Wochschr.* 4, 1540-3(1925).—A repetition of the work of Friedenwald and Grove (*C. A.* 16, 2551), the results being essentially corroborative. The test is, however, not specific for carcinoma though almost invariably positive with carcinomatous patients. M. H.

The action of insulin in the spasmophilia of infants. A. ADAM. *Klin. Wochschr.* 4, 1551-2(1925).—Rickets and spasmophilia are due to a disturbance in carbohydrate metabolism. Assimilation metabolism, which is necessarily great in growing animals, is dependent upon maintenance metabolism, which is essentially a carbohydrate and fat combustion. Anything that reduces the latter will injure the former (vitamin deficiency, fever, infectious diseases, lack of nourishment), and tend to produce spasmophilia. Conversely, easily assimilable food (cod-liver oil) or irradiation with ultraviolet light tends to reduce spasmophilia because they enhance maintenance metabolism. Carbohydrate metabolism can be enhanced by increasing the concn. of glucose in the blood (diet rich in sugar, and demobilization of glycogen by injecting adrenaline or acid) and by facilitating its fixation to the body cells (insulin). Spasmophilics who have been treated with sugar, insulin and adrenaline show either a reduction or a complete cessation of symptoms. Details of treatment are given. MILTON HANKE

Lipoid character of the granular substance of eosinophiles. ALFRED NEUMANN. *Klin. Wochschr.* 4, 1552(1925).—In a previous publication N. has shown that the eosinophile granular substance is a lipid that stains with Sudan III (cf. *C. A.* 19, 665, 993). The lipid is bound to some other constituent of the protoplasm, possibly protein, from which it can be sepd. by means of acid alc. This treatment destroys its oxidative principle (benzidine reaction). The intensity of the benzidine reaction is directly proportional to the N content of the prepn. MILTON HANKE

Blood sugar studies in pulmonary tuberculosis. PAUL HECHT. *Klin. Wochschr.* 4, 1595-7(1925).—Well-advanced cases of pulmonary tuberculosis are hypoglycemic (fasting) even when the patients are fairly well nourished. MILTON HANKE

Electrolyte distribution between blood and tissues. H. BEHRENDT. *Klin. Wochschr.* 4, 1600-1(1925).—In *parathyroid tetany* (dog), the K content of the muscles steadily increases with the severity of the symptoms; the Ca content of the muscles remains unchanged, but is reduced in the serum; the concn. of lactacidogen phosphate is not reduced. After poisoning with *guanidine* the K content of the serum rises markedly after a transitory decrease; the Ca content of the serum is unchanged; that of the muscles is reduced; the K content of the muscles is unchanged. These changes in the electrolyte content of the muscles occur also in de-nervated muscles. From the above it is obvious that parathyroid tetany cannot be due to poisoning with guanidine. Local tetanus, produced by injecting tetanus toxin, is not associated with any const. change in the Ca, K or lactacidogen content of muscle. MILTON HANKE

Theory and method of the serological demonstration of lues. H. SACHS. *Klin. Wochschr.* 4, 1630-3(1925).—Lipoid antibodies can be engendered in an animal by injecting alc. exts. of organs from the same kinds of animal, or even com. lipoids, mixed with swine serum. Other serums are less effective than swine serum; horse serum is almost inactive. The spirochete functions somewhat like the swine serum; it assists the body cells to produce auto-antibodies against lipoids. Of all infectious conditions, syphilis is most apt to lead to auto-antibody formation; but other infectious diseases may also be associated with a similar change, e. g., leprosy, malaria, tuberculosis and endocarditis lenta. This explains the fact that the Wassermann reaction, the Sachs-Georgi reaction and the Meinelke flocculation test may, occasionally, be positive when a lueic infection is absent. These 3 tests are identical in that they all are methods for demonstrating the presence, in the serum, of an auto-antibody against lipid. MILTON HANKE

The influence of the sun's rays upon complement. MARTIN JACOBY AND MARGURETE JACOBY. *Biochem. Z.* 151, 314-7(1924).—Fresh guinea-pig serum was exposed to sunlight, but no effect upon the complement could be detd. W. D. L.

Flocculation of antimeningococcus serum in the presence of alcohol extracts of meningococci. R. DUJARRIC DE LA RIVIERE AND ETIENNE ROUX. *Ann. inst. Pasteur* 39, 368-81(1925); cf. *C. A.* 19, 90, 120.—Antimeningococcus serums flocculate in the presence of alc. ext. of meningococci and tincture of benzoin. The benzoin renders the reaction readily visible without optical aid. The method is of no value with antitoxic serums. E. R. LONG

Diagnostic and prognostic value of the blood sugar determination in chronic glucosuria. HAQVIN MALMROS. *Acta med. Scand.* 62, 294-318(1925).—Every case of diabetes mellitus in young people where the fasting sugar level is about 0.14% must be regarded as serious with a poor prognosis. Also in elderly people with a fasting

blood sugar of 0.27% the prognosis must be regarded as serious. In cases of chronic glucosuria with a normal fasting blood sugar level a sugar tolerance test must be made to rule out glucosuria *innocens* of the renal type which is entirely harmless. Where the glucosuria *innocens* is associated with pathol. alimentary hyperglucemia a careful observation is probably necessary for a period of 3-4 years with blood sugar detns. twice a year. S. MORGULIS

Observations on the blood sugar curve of diabetics in the course of the day. ALFRED FLAUM. *Acta med. Scand.* 62, 372-7; *Compt. rend. soc. biol.* 93, 380-2 (1925).—The blood sugar level in the afternoon is lower than in the morning, the difference on the av. being 0.02%. Neither the age or sex, nor the duration of the diabetes seems to have any connection with this drop in the sugar curve during the afternoon. S. M.

Studies on hemoglobinuria due to cold. E. B. SALÉN. *Acta med. Scand. Suppl.* XI, 704 pp (1925). S. MORGULIS

Action of anti-fibrinogen serum on red blood corpuscles. HANS DAVIDE. *Acta med. Scand. Suppl.* XIII, 123 pp. (1925).—Special prepn. of the fibrinogen is emphasized and the method is described. Serum prepd. against guinea-pig fibrinogen has powerful erythrocyte-destroying action on guinea pigs, and this also is true for dog or rabbit anti-fibrinogen serum when introduced into these animals, but the hemolytic action of the anti-fibrinogen sera is not effective in heterologous animals. Fibrinogen from certain species of animals produces specific hemolysins and hemagglutinins *in vitro*. Thus, guinea-pig, dog, rabbit and human fibrinogen produces hemolysins and hemagglutinins for the homologous corpuscles; but horse or sheep fibrinogen produces very little or no hemolysins and hemagglutinins. It thus follows that between the 2 kinds of sera prepd. with material from guinea pig, dog, rabbit and man, *i. e.*, species whose corpuscles produce weak hemolysins but very powerful hemagglutinins, there is only a difference in degree, the anti-fibrinogen serum contg. somewhat weaker hemolysins and much more powerful hemagglutinins. Between the 2 sera prepd. from horse and sheep material, *i. e.*, animals whose corpuscles produce very potent hemolysins but no agglutinins, there is no similarity, since the anti-fibrinogen sera do not contain these hemotoxic antibodies. The reasons are also discussed for the different quantities of serum required to destroy homologous blood corpuscles *in vivo* or *in vitro*. Anti-fibrinogen sera possess a marked capacity for hemolyzing sheep corpuscles when these are prepd. with fibrinogen from animals which contain heterophil antigen. These anti-fibrinogen sera contain distinct heterologous hemagglutinins when tested with old corpuscles. Absorption of anti-guinea-pig-fibrinogen serum with guinea-pig fibrinogen eliminates all its hemotoxic properties, whereas absorption with rabbit fibrinogen, guinea-pig or sheep corpuscles does not materially affect or does not at all eliminate the hemotoxic properties of the serum. The hemotoxic properties of anti-fibrinogen serum must, therefore, have been developed by the fibrinogen itself. From the difference in behavior of various fibrinogens towards the pptg. action of the salt it is concluded that the most easily pptd., which is also the least dispersed fibrinogen, produces hemolysins most easily, whereas the most dispersed and hence most difficultly pptd. fibrinogens are entirely devoid of the capacity for producing those antibodies. These differences in the fibrinogen behavior are furthermore attributed to different degrees of development in the various species studied. S. M.

Immunization of guinea pigs with injections of eclamptic serum. LÉVY-SOLAL, A. TZANCK and JEAN DALSACE. *Compt. rend. soc. biol.* 92, 957-8 (1925).—Guinea pigs desensitized against horse serum by previous intracardiac injections of small amts. have likewise become immunized against eclamptic serum. S. MORGULIS

Transformation in certain animal tissues of deposits of oxalate into calcium carbonate. M. LOEFLER, R. SCHULMANN and J. TONNET. *Compt. rend. soc. biol.* 92, 1024-5 (1925).—In the peritoneum of guinea pigs 11.8% of introduced Ca oxalate is transformed into CaCO_3 in 11 days; at the end of 60 days this may reach 12.7%. In the muscles the transformation does not exceed 7%; in the skin there is no transformation. S. MORGULIS

Nitrogenous metabolism in Basedow's disease. G. ETIENNE, G. RICHARD and J. ROUSCH. *Compt. rend. soc. biol.* 92, 1094-5 (1925).—"If the N metabolism is sometimes disturbed in various forms of Basedow's disease, it is difficult to define the conditions and the mechanism of its modifications." **Nitrogenous metabolism during thyroid insufficiency.** *Ibid* 1095-6.—In congenital myxedema there was found an increased blood urea N as well as Ambard coeff. above the normal. The condition is not so definite in cases of acquired thyroid insufficiency. Administration of thyroïd ext. relieves the symptoms of disturbed N metabolism just as it does those of basal metabolism. S. MORGULIS

Relation between the rate of sedimentation of red blood cells and the surface ten-

sion in the condition of shock. EDGARD ZUNZ. *Compt. rend. soc. biol.* 92, 1119-22 (1925).—The slow rate of sedimentation of the red cells during anaphylactic shock is shown to depend upon the increase in the number of the cells and the greater viscosity of the blood. S. MORGULIS.

Toxic action of poisons from *Adamsia palliata* on decapod crustacea. J. CANTACUZÈNE. *Compt. rend. soc. biol.* 92, 1131-3 (1925).—Exts. of *Adamsia* act as a powerful convulsive poison on various decapods. Immunity of *Eupagurus prideauxii* against the poisons of *Adamsia palliata*. *Ibid* 1133-6.—*Eupagurus* possesses a strong immunity towards the poison of *Adamsia* which is believed to have been acquired by the former through prolonged contact with the latter, and constantly absorbing (presumably by way of the intestinal canal) its poisonous excretions. S. MORGULIS.

Importance of determining the fibrinogen in the cerebrospinal fluid as a means of differentiating two varieties of hyperalbuminosis: mechanical and inflammatory. J. PERISSON, L. POLLET AND P. BRÉANT. *Compt. rend. soc. biol.* 92, 1201-3 (1925). S. MORGULIS.

Platelets and anaphylactic shock. CH. KŁECKI AND C. PELCZAR. *Compt. rend. soc. biol.* 92, 1206-11 (1925).—An excess of platelets in the organism does not exercise any influence on the anaphylactic phenomena. An anti-platelet plasma causes in animals sensitized with normal plasma of the same species an anaphylactic shock the severity of which depends upon the degree of sensitization. The disappearance of the platelets from the circulation is always accompanied by a hyperthermia. S. M.

Studies of the total serum calcium in true epilepsy and in related conditions. P. J. REYTER. *Compt. rend. soc. biol.* 92, 1325-6 (1925).—Serum Ca detns. were made on 2 epileptics and 6 individuals suffering from related maladies. These detns. were made 3 times on each individual. The value found ranged from 8.3 to 11.5 mg. per 100 cc. serum. In a single case of an imbecile epileptic of the Mongoloid type the Ca was low (7.1-8.3 mg.). S. MORGULIS.

Studies of the hydrating action of plasma and serous fluids from edematous subjects. MARCEL LABBÉ, P. L. VIOLE AND LELIÈVRE. *Compt. rend. soc. biol.* 92, 1359-61 (1925).—The plasma and serous fluids from edematous persons produce a real edema in frog gastrocnemius muscles which manifests itself as an infiltration of the intramuscular connective tissue. S. MORGULIS.

Urinary ammonia and acidity in epileptics. R. RAFFLIN. *Compt. rend. soc. biol.* 92, 1429-31 (1925).—During attacks of epilepsy the hourly elimination of NH_3 and of urea is greatly increased and the p_{H} is much lowered. These phenomena are regarded as a defence against alkalosis. S. MORGULIS.

Anaphylactic shock in the gestating rabbit. PIERRE SIMONON AND LOUIS FERNIER. *Compt. rend. soc. biol.* 92, 1447-9 (1925).—Gestation has no effect whatever on the development of shock. Sensitization, anaphylaxis and gestation in the rabbit. *Ibid* 1449-50.—Pregnancy does not interfere with sensitization nor does it change the intensity of anaphylaxis. S. MORGULIS.

Effect of insulin on liver glycogen. BERTHE HEYMANS AND C. HEYMANS. *Compt. rend. soc. biol.* 93, 50-2 (1925).—Expts. on rabbits show that the livers of animals which die in a state of prolonged hypoglycemia contain a small amt. of glycogen (less than 0.5 g.); the livers of animals which have been killed either before or during the onset of convulsions still contain a considerable quantity of glycogen (2-3 g.), and the livers of rabbits receiving simultaneously injections of insulin and of glucose are not richer than those of rabbits treated with insulin alone. Finally, if the development of convulsions is prevented by inducing deep anesthesia, the liver glycogen is not diminished in animals dying in a state of hypoglycemia. S. MORGULIS.

Acidosis and diabetic coma in depancreatized dogs. E. HÉDON. *Compt. rend. soc. biol.* 93, 89-92 (1925). S. MORGULIS.

Potassium content of epithelial grafts in castrated mice. M. LOEPER, R. TURPIN AND ZIZINE. *Compt. rend. soc. biol.* 93, 94-5 (1925).—The K of the blood has been shown to increase with the development of cancer. The authors examined the Ca and K of normal and castrated mice with grafted mammary epitheliomas. Castration diminishes the K content of the mice's body, and following castration the tumor grafts develop abnormally and frequently undergo regression. Likewise, the K content of grafts in castrated mice is much smaller than in controls. S. MORGULIS.

The level of total and neutral sulfur in the serum of melanodermics. M. LOEPER, J. OLLIVIER AND J. TONNET. *Compt. rend. soc. biol.* 93, 95-7 (1925).—Method: The serum is obtained from 50 cc. blood and is pptd. with CCl_3COOH . The filtrate is divided into 2 portions: in portion 1 the total SO_4 is hydrolyzed with HCl, and in portion 2 the total S is detd. after preliminary oxidation with KClO_4 . The final detn.

is made by means of the benzidine pptn. The total S normally varies between 0.08 and 0.10 g. (per l. ?), 20% of which is neutral S and 80% in the form of total SO_4 . Data on the different ratios in various pathological conditions are reported. In cases of pigmentation accompanying cirrhosis the level of total S is diminished (melanin infiltrating the epidermis contains 7-9% S) while the ratio neutral S/sulfate is increased according to the degree of pigmentation. S. MORGULIS

Cholesterol in the blood serum of tuberculous patients. L. JULLIEN AND MARTIN-ROSSET. *Compt. rend. soc. biol.* 93, 177-8(1925).—No relation between the blood cholesterol and tuberculosis can be found. S. MORGULIS

Histamine as means of testing the secretory activity of the stomach. P. CARNOT AND E. LIBERT. *Compt. rend. soc. biol.* 93, 242-4(1925). S. MORGULIS

Composition of the blood in chloride retention without edema. LÉON BLUM AND VAN CAULAERT. *Compt. rend. soc. biol.* 93, 283-5(1925).—In cases of Cl retention without H_2O retention there is great concn. of the blood plasma and a striking increase in Cl while the Na is diminished. The absence of a water retention is attributed to the low Na content. It is also concluded that Cl retention is only a secondary factor in condition of water retention. Retention of chlorides with edema. *Ibid* 285-7. Bright's disease where Cl retention is associated with H_2O retention it is claimed that Na level of the plasma is above normal. S. MORGULIS

The relation between chloride, sodium and water. LÉON BLUM, M. DELAVILLE AND VAN CAULAERT. *Compt. rend. soc. biol.* 93, 287-9(1925).—A certain min. of NaCl is necessary to cause H_2O retention. If this is not attained, either through lack of Cl or of Na, there is a loss of water, as in diabetes (low Cl) or in dry Cl retention where there is a low Na. For the occurrence of a H_2O retention a preponderance of Na over Cl is actually required. Normally the g.-mol. ratio of Na/Cl is 1:3, but the same relation may also exist in anhydremia as in diabetes with low Cl. On the contrary, in cases of hydremia the ratio Na/Cl may vary considerably both up and down. It is also stated that in cases of pronounced hydremia part of the Na and of the Cl is in colloidal state (30 and 33%). **Physical state of sodium and chloride in certain pathological conditions.** *Ibid* 295-7.—Changes in the ultrafilterability of Na and of Cl of the blood in various conditions are described. S. MORGULIS

Studies of the mechanism of acidosis. LÉON BLUM AND M. DELAVILLE. *Compt. rend. soc. biol.* 93, 289-91(1925).—A general discussion. Cf. C. A. 19, 2701. S. M.

Changes in the blood in diabetic acidosis. Condition of the chlorides. LÉON BLUM, M. DELAVILLE AND THIERS. *Compt. rend. soc. biol.* 93, 292-3(1925).—The Cl content of the blood diminishes just as the alk. reserve. As the severity of the acidosis increases the elimination of Cl diminishes. Furthermore, the Cl, which in normal individuals is entirely ultrafilterable, loses this property partly during acidosis. **Changes in the blood in diabetic acidosis. Condition of the sodium.** *Ibid* 294-5.—Na increases in the blood of diabetics with acidosis. If the onset of the acidosis is rapid, the Na continually loses its ultrafilterability and assumes colloidal property. S. M.

The albumoses of the plasma and urine in catarrhal icterus. PAUL CHEVALLIER. *Compt. rend. soc. biol.* 93, 303-4(1925). S. MORGULIS

Alterations caused by acute nephritis. H. BIERRY, F. RATHERY AND SIGWALD. *Compt. rend. soc. biol.* 93, 325-7(1925).—In the case of a young girl poisoned with Hg the following observations were made on the blood changes during the continuance of the acute nephritis. The nephritis passed through 3 distinct phases: (1) complete anuria for 5 days; (2) oliguria for 3 days (20, 30 and 75 cc.); and (3) a polyuria phase until the daily urine output reached 3 l. per day. The non-protein N of the blood attained 580 mg. per 100 cc., the greatest rise occurring in the last phase. The blood sugar also increased to 270 mg., the sugar curve following very closely that of the non-protein N. The inorg. P increased to 13.6 mg., diminishing again later to 5.5 mg. when the polyuria stage has already become well marked. The Ca behaved in a similar manner. The data made by the Van Slyke method of the alk. reserve and by the Sellard method of the urinary pH changes after the ingestion of NaHCO_3 were not concordant in results. It is suggested that an acidosis may actually exist though it is not betrayed by a study of the alk. reserve. S. MORGULIS

Relation between total non-protein nitrogen and the amount of nitrogen metabolized. KARL PETRÉN AND M. ODIN. *Compt. rend. soc. biol.* 93, 373-5(1925).—Evidence is presented to show that the non-protein N of the blood varies directly with the amt. of N metabolized. **Non-protein nitrogen in diabetic coma and hypoglycemia.** *Ibid* 375-6(1925). S. MORGULIS

Importance of the blood sugar level for prognosis in diabetes mellitus. H. MALMROS. *Compt. rend. soc. biol.* 93, 377-9(1925).—Mortality from diabetes ranges from

00 to 33.3% with increasing age. A study of the blood sugar in diabetic patients also shows that the mortality varies from 0 to 100% according as the fasting blood sugar varies from 0.11–0.13 g. up to 0.28–0.40 (and higher) per 100 cc. S. M.

The blood urea nitrogen in scarlatina. M. CINCA AND P. NADEJNE. *Compt. rend. soc. biol.* 93, 389–91(1925).—The urea N of the blood in scarlatina patients cannot always be inferred from the urinary findings. A rational dietary treatment can be arranged only on the basis of the blood urea findings. S. MORGULIS

Surface tension of plasma after injecting into guinea pigs serum globulin from normal guinea pigs. E. B. MCKINLEY AND EDGARD ZUNZ. *Compt. rend. soc. biol.* 93, 59–62(1925).—A lowering of the plasma surface tension following an injection of a suspension of serum globulin from guinea pigs occurs only very exceptionally independently from the presence of hemoglobin. S. MORGULIS

Surface tension of plasma in spontaneous incoagulable shock. EDGARD ZUNZ. *Compt. rend. soc. biol.* 93, 463–5(1925).—Surface tension is lowered. S. MORGULIS

Experimental typhosis, or caryoclastic crisis, through injection of aniline derivatives. A. P. DUSTIN. *Compt. rend. soc. biol.* 93, 465–7(1925). S. MORGULIS

Immunization against tetany and the production of tetany antitoxin. G. RAMON AND P. DESCOMBES. *Compt. rend. soc. biol.* 93, 508–9(1925). S. MORGULIS

The energy expenditure of the diabetic dog in relation to the external temperature. H. HENON. *Compt. rend. soc. biol.* 93, 594–6(1925).—The basal metabolism of the diabetic dog is about 30% higher than that of the normal dog. But, whereas the basal metabolism of normal dogs increases considerably with a fall in external temp., this change is not observable in the diabetic dog except when it is treated with insulin. S. MORGULIS

The role of the vagus nerve and of the thyroid gland in sensitization to peptone shock. L. GAGRELON AND D. SANTENOISE. *Compt. rend. soc. biol.* 93, 598–9(1925). S. MORGULIS

Albuminuria caused by injections of egg white into rabbits. MARCEL GARNIER AND ERNEST SCHULMANN. *Compt. rend. soc. biol.* 93, 600–2(1925).—Egg white contains some toxic principle which is responsible for the production of albuminuria which is of the same nature as that caused by other toxins. The toxic substance of the egg white is not affected by heating for 1 hr. at 55°. S. MORGULIS

Absence of elective fixation in cancer tissues. Elimination of radium injected into the organism. R. FERROUX AND A. LACASSAGNE. *Compt. rend. soc. biol.* 93, 604–5(1925). S. MORGULIS

Effect of radium emanation on the toxic group of the tetanus toxin. R. FERROUX AND S. MUTERMILCH. *Compt. rend. soc. biol.* 93, 608–10(1925). S. MORGULIS

Effect of radium emanation on the antigen group of the tetanus toxin. S. MUTERMILCH AND R. FERROUX. *Compt. rend. soc. biol.* 93, 611–2(1925). S. MORGULIS

The mechanism of dry chloride retention. LÉON BLUM AND VAN CAULAERT. *Compt. rend. soc. biol.* 93, 692–3(1925).—Cl retention is conditioned upon a relative impermeability of the kidney for Cl. As a result of this the kidney becomes surcharged with Cl which still further prevents its excretion. **The mechanism of dry chloride retention. Sodium and water.** *Ibid* 694–5.—In the dry Cl retention there is an increased excretion of Na, and this disproportionate amt. of Cl in the tissues is the reason for the desiccation of both tissues and body fluids. S. MORGULIS

Mechanism of chloride retention with water in parenchymatous nephritis. LÉON BLUM, M. DELAVILLE AND VAN CAULAERT. *Compt. rend. soc. biol.* 93, 696–7(1925).

Classification of nephritis. *Ibid* 697–8.—Three types of nephritis are distinguished: with normal excretion of NaCl; with an increased excretion of Na and consequently a large retention of Cl; and finally with a greater diminution in the Na elimination than corresponds to the Cl excretion. In the first group the patients behave like healthy individuals, losing 1–2 kg. in wt. with the restriction of salt intake, but regaining this when the salt is added to the diet. In the second group the patients gain wt. when the salt intake is restricted, and frequently lose wt. upon a salt-contg. regime. In the third group belong patients in which the ingestion of salt causes edema with excessive increase in wt. and the salt restriction brings about loss in wt. through dehydration.

Acidosis in Bright's disease. *Ibid* 698–700.—The occurrence of acidosis or alkalosis in nephritis is primarily conditioned upon the proper proportions of Na and Cl: a preponderance of Na over Cl conduces to alkalosis while a preponderance of Cl over Na to acidosis. Acidosis is therefore also a condition of hyperchloremia and of hyposodemia.

Acid-base equilibrium in uremia. *Ibid* 701–2.—The fluctuations in alk. reserve are shown to be related to the exchange of Na and Cl between tissues and blood. **The pathogenesis of uremia.** *Ibid* 703–4.—Uremia is regarded as being due to a loss of

balance in the mineral constituents of the tissues, and a demineralization affecting the colloidal portion of the tissues, particularly the protein, which manifests itself clinically as uremia. In uremia unaccompanied by edema it is shown that the Cl is retained not only in the fluids (cerebrospinal fluid) but also in the cellular elements (red cells) of the body. S. MORGULIS

Changes in basal metabolism of insane, in relation to respiratory capacity and respiratory quotient. A. OBREGIA, G. PADRANO, I. CONSTANTINESCO AND N. TOMOVICI. *Compt. rend. soc. biol.* 93, 746-7 (1925).—The basal metabolism is not a function of the respiratory quotient but is dependent on the respiratory capacity. However, in the large number of insane it has been noted that the basal metabolism diminishes together with the respiratory quotient. In dementia precox the basal metabolism is generally lower than normal; in general paralysis this is as frequently lower as it may be higher than normal; and in maniac depressives it is likewise sometimes increased and sometimes diminished. The daily variations are so great as probably to deprive these detns of any value. S. MORGULIS

Suprarenal capsule in two cases of death following epileptic ats. A. IOPEA AND GH. EUSTATZEF. *Compt. rend. soc. biol.* 93, 747-9 (1925).—Disappearance of the lipo chloesterol inclusions of the cortical layer is noted. S. MORGULIS

Variations in cholesterolemia during epileptic attacks. A. POPEA AND A. VIGOL. *Compt. rend. soc. biol.* 93, 749-50 (1925).—The blood cholesterol is lowered during an epileptic attack. S. MORGULIS

Studies on rat carcinoma. MASAO IWANO. *J. Biochem. (Japan)* 4, 481-9 (1925).—The takes of tumors in old rats (7-10 months old) are unaffected by starvation of the host, but the growth of the tumors is somewhat retarded by underfeeding. At periods of 16-17, 20-22, and over 25 days of growth it was found that the lecithin value remained practically constant, while the cholesterol increased with age of the tumor so that the ratio lecithin:cholesterol diminished with age. The cholesterol was mostly in the free state. The lipid content of the rat tumors was little affected by injection of cholesterol, lanolin or lecithin or by feeding flesh powders. In rats injected with cholesterol and lanolin the blood cholesterol was higher, but in those injected with lecithin it was lower than normal. S. MORGULIS

"Dry" chloride retention. L. BLUM AND VAN CAULAERT. *Bull. soc. med. hopitaux* 49, 1065 (1925); *J. Am. Med. Assoc.* 85, 779.—Retention of chlorides without edema is frequent in cases of urine intoxication, presenting purulent urine, polyuria or pollakiuria. In such cases, with excess of chlorides and deficit of Na, a salt-free diet is even more beneficial than in chronic nephritis. **Role of sodium in dropsy.** *Bull. soc. med. hopitaux* 49, 1067 (1925); *J. Am. Med. Assoc.* 85, 779.—There may be simultaneous retention of Na and Cl but the characteristic feature is the higher ratio of the Na to the Cl. When Na is in excess there is diln. of the blood. This confirms the role of Na in dropsy. L. W. RIGGS

Regulatory mechanism of the metabolism of the purines and diabetes insipidus. CHARLES KAYSER AND ÉLAINE LEBRETON. *Compt. rend.* 180, 1794-5 (1925); cf. Camus and Gournay, *C. A.* 19, 1596.—The following results of this study do not confirm those of Camus and his co-workers: In the normal dog the urine contains but little uric acid, frequently less than $1/3$ that of the oxypurine content. The uric acid is largely oxidized to allantoin before elimination. Lesion of the *tuber cinereum* adds nothing to the normal phenomena. The significant factor is the ratio of the purine bases to allantoin. The increase in the ratio of purine bases to uric acid in human diabetes insipidus is confirmed, but in no case was the total elimination of purines as large as 3.0 g., nor did the uric acid ever totally disappear. Some of these differences may be due to different methods of estg. purines and uric acid. The ingestion of water in a healthy subject on a purine-free diet is followed by remarkable changes in the ratio oxypurine:uric acid; thus a subject passing 900 cc. of urine showed a ratio of 1/5.1, but the next day the vol. of urine was 3800 cc. with a ratio of 1/4.3, and on the 3rd day the vol. of urine was 3460 cc. and the ratio 1/2. Three weeks later the expt. was repeated with similar results. It appears that the oxidation of the purines and uric acid takes place at the level of the kidneys and in the case of polyuria the slight concn. of the oxypurines and the very short period during which the purines are subjected to the action of enzymes are sufficient to account for the large increase of purines in the urine. It is not believed that in the region of the *tuber cinereum* is a center which regulates the metabolism of the nucleoproteins. L. W. RIGGS

Relations between the experimental displacement of muscular isoelectric points and the evolution of implanted tumors. F. VLES AND A. DE COULON. *Compt. rend.* 181, 147-9 (1925); cf. *C. A.* 18, 3067.—About 170 mice in 12 groups, each group contg

a sufficient no. of controls, were used. Certain animals in each group received an injection in the fold of the groin, either of turpentine which elevates, or of emery powder which depresses, the isoelec. point. Then after a no. of days, varying with each group of animals, an epithelial tumor was implanted either on the same side or on the side opposite to that of the previous injection. Controls received the graft without the previous injection. An index (i) of relative receptivity of the graft was expressed by the ratio $(S-T)/S$, in which S was the percentage of grafts having taken in the exptl. animals and T the percentage of grafts having taken in the controls. With a previous injection of turpentine the index is at first positive and increases during 15 days, then decreases and becomes strongly negative (*i. e.*, fewer grafts taking in the injected animals than in the controls). With a previous injection of emery powder the index is strongly positive when the injection and graft are made at the same time, then rapidly decreases to negative. Applying isoelec. views to the 2 cases it is seen that the displacements of the isoelec. point are roughly parallel to the changes in the index of receptivity for the grafts.

L. W. RIGGS

Relation of calcium content of the spinal fluid to postlumbar puncture headache. MARCUS NEUSTADTER, W. W. HALA AND ALEXANDER TOLSTOUCHEW. *J. Am. Med. Assoc.* 85, 347-8 (1925).—Ca was present in the spinal fluid in each of 133 cases. There seemed to be no relation between the Ca content and the pathologic condition of the fluid or of the patient, with the possible exception of cases of chorea, brain tumors and abscess, as compared with the findings in the normal fluids. The Ca content of the spinal fluid appears to bear no relation to postlumbar puncture headache. In a series of cases in which Ca did temporarily relieve the headache, the control cases showed the same results to follow other means of treatment.

L. W. RIGGS

Tuberculin. Chemical composition of the active principle and the nature of the tuberculin reaction. E. R. LONG AND FLORENCE B. SEIBERT. *J. Am. Med. Assoc.* 85, 750-2 (1925).—The active principle of tuberculin is nondialyzable, is not absorbed by animal charcoal, is destroyed by trypsin, is maximally but incompletely pptd. by AcOH at pH 4.0, and is completely pptd. by satn. with $(NH_4)_2SO_4$. The product of pptn. by $(NH_4)_2SO_4$ is of a protein nature and can be sepd. into 3 protein fractions: (1) a water-sol. heat-coagulable protein, (2) a non-coagulable, alkali-sol., water-insol. protein and (3) a non-coagulable water-sol. protein. Of these the first and third appear to be the most potent. The nature of the highly sp. toxic action of this substance on the tissues of a tuberculous animal is not known. Preliminary expts. indicate that the tissues of the sensitized (tuberculous) animal do not act on tuberculin in such a manner as to render it toxic for normal animals, nor do they bind the active principle in appreciable quantity, so as to render a tuberculin prepn. less toxic for another tuberculous animal.

L. W. RIGGS

Curve of inorganic blood phosphates during the sugar tolerance test. Significance in diagnosis and prognosis. F. W. HARTMAN AND ADOLPH BOLLIGER. *J. Am. Med. Assoc.* 85, 653-6 (1925).—Seven charts of curves are constructed from the data on inorg. blood phosphates and sugar in a series of clinical cases. The effects of insulin on phosphate utilization are comparable to those on carbohydrate utilization. Abnormal carbohydrate metabolism may be divided into 7 groups by means of the blood phosphate curve. Slight abnormalities and the functionless pancreas are readily identified through the phosphate curve. Abnormal carbohydrate metabolism associated with the pituitary, and possibly with the suprarenals, may be recognized.

L. W. RIGGS

Further studies of the cerebrospinal fluid in infants and young children. S. McLEAN AND F. H. VON HOFE. *Am. J. Med. Sci.* 170, 82-98 (1925).—In cerebrospinal meningitis the sugar content of the cerebrospinal fluid is diminished in cases with moderately increased cell counts, and in those with high counts sugar is lacking. A gradual increase in sugar content coincides with decrease in cells. In encephalitis the sugar content is higher than in any other type of case. In encephalitis due to Pb poisoning the globulin test is positive. In tuberculous and pneumococcal meningitis the sugar is reduced. Chloride detns. are of little diagnostic value in meningial or extrameningeal conditions in infancy and early childhood. The sugar content is practically normal in congenital syphilis but in syphilitic meningitis, as in other conditions with high cell counts, the glucose is reduced. The sugar in the cerebrospinal fluid in pneumonia is normal. In disturbances of the digestive system it is increased.

G. H. S.

Antigenic substance of the bacterial cell. HANS ZINSSER AND TAKKO TAMURA. *J. Exptl. Med.* 42, 311-21 (1925).—The substance of the bacterial cell can be roughly divided into 2 antigenic entities, the so-called "nucleoprotein" and the residue substance or sol. material. Immunization with the nucleoprotein, if such is rendered

free of bacterial bodies or fragments of bacterial bodies by Berkefeld filtration, incites the production only of antinucleoprotein antibodies, which, with slight group overlapping, are species-specific but are not type-specific to the same degree as the residue antibodies. Immunization with dissolved residue alone leads to no antibody formation. This residue represents the haptophore group upon which specificity depends, and which, in the simple process of soln., is disrupted from another substance together with which it represents a complete antigen in the antibody-forming sense. The formation of sp. antiresidue antibodies is apparently dependent upon the injection of morphologically formed elements. While antiresidue antibodies are only formed when undisturbed bacterial cell substances are present in the immunizing substance, immunization with whole bacteria, even when attempts are made to preserve them from soln. by formalin leads to the formation of both antiresidue and antinucleoprotein bodies, probably because a certain amt. of soln. inevitably takes place after injection within the animal body. C. J. WEST

Immunological reactions of the isolated carbohydrate and protein of pneumococcus. O. T. AVERY AND H. J. MORGAN. *J. Exptl. Med.* 42, 347-53 (1925); cf. *C. A.* 17, 2747.—The isolated carbohydrate of pneumococcus is non-antigenic in the sense of stimulating antibody formation. The isolated protein of pneumococcus is antigenic; it induces the formation of antibodies which react with the nucleoprotein fraction of organisms of homologous and heterologous types. The anti-protein sera do not agglutinate type-specific strains of pneumococcus or react with the carbohydrate derived from them. C. J. WEST

Antigenic properties of solutions of pneumococcus. O. T. AVERY AND J. M. NEILL. *J. Exptl. Med.* 42, 355-65 (1925); cf. preceding abstr.—Intact pneumococci, possessing sp. antigenic powers unimpaired by cultural or other procedures, give rise to agglutinins for organisms of the homologous type and to precipitins for the type-specific carbohydrate derived from them. Solns. of pneumococci free of all formed elements, but contg. the carbohydrate and protein of the original cell, fail to stimulate the formation of type-specific antibodies. Sera prepd. in this manner do not react with the carbohydrate constituent of the cell and do not agglutinate organisms of the homologous type. The loss of this antigenic function is related to changes incurred during dissolution of the bacterial cell. Solns. of the cellular substances of pneumococcus, although lacking the sp. antigen of the whole cell, induce the formation of antibodies with pneumococcus protein regardless of the type from which the latter is derived. C. J. W.

Immunological relationships of cell constituents of pneumococcus. O. T. AVERY AND MICHAEL HEIDELBERGER. *J. Exptl. Med.* 42, 367-76 (1925); cf. *C. A.* 17, 2747.—The general immunological significance of the intact pneumococcus cell and of its protein and carbohydrate components is discussed. C. J. WEST

Immunological relationships of Streptococcus viridans and certain of its chemical fractions. I. Serological relations obtained with antibacterial sera. REBECCA C. LANCEFIELD. *J. Exptl. Med.* 42, 377-95 (1925).—Agglutination and pptn. by the sp. substance of *Streptococcus viridans* are parallel phenomena. Sep. sp. substances have been extd. from strains which are distinct by ordinary serological tests. Preliminary chem. examn. indicates that the sp. substances may be complex carbohydrates. A close relationship between nucleoproteins from different strains of *S. viridans* is suggested by the existence of a certain amt. of cross-pptn. and a larger degree of cross-complement fixation. But the occurrence of stronger reactions with homologous nucleoproteins than with heterologous indicates that there is some degree of individual difference in proteins from sep. strains. Two distinct antibodies are present in the sera antibacterial for *S. viridans*; 1 of higher titer implicated in the parallel phenomena of agglutination and pptn. by the sol. sp. substance, the other usually of lower titer and involved in the pptn. by nucleoproteins but probably little, if at all, in agglutination. II. Serological reactions obtained with antinucleoprotein sera. *Ibid* 397-412.—The immunological behavior of 2 cell constituents of non-hemolytic streptococci has been studied. One, the so-called nucleoprotein, is relatively non-sp. and gives rise to an antibody which shows group reactions with nucleoproteins of related species. The other is non-protein by qual. chem. tests. Preliminary chem. examn. has indicated that it may be a carbohydrate. Although this substance is highly reactive with the sp. antibodies produced by the intact bacterial cell, yet in its chem. purified condition it is probably non-antigenic. Sp. serological reactions with this substance are closely related to sp. agglutination of the microorganism. The study of sera prepd. by immunization with the chemically extd. protein has shown the presence of antibodies for nucleoproteins alone. No antibodies against the sp. sol. substance have been found in these sera. The protein antibodies are little, if at all, concerned in causing agglutination. Precipitin tests,

complement-fixation reactions and absorption expts. have been used to analyze the group relationships with the nucleoproteins of other species. The proteins of each species of Gram-positive cocci studied were immunologically similar within the species and showed definite relationships to the proteins from related species. Proteins from bacteria of unrelated species did not react with antisera against streptococcus protein. Two distinct antibodies have been demonstrated in antisera prepd. against living bacteria. By prolonged immunization it was possible to produce sera with a high protein content as well as sp. antibodies. With ordinary methods, however, the immune sera had a low content of relatively non-sp. protein antibodies but a high titer for sp. antibodies. The sp. antibodies were not reactive with proteins but were active with high dilns. of the sol. sp. substance and were responsible for the parallel sp. agglutination. Absorption expts. showed that the 2 antibodies in antibacterial sera were immunologically distinct.

C. J. WEST

II—PHARMACOLOGY

AI FRED N RICHARDS

The chemistry and chemotherapy of the tropene derivatives. G. M. DYSON. *Ind. Chemist* 1, 328-30 (1925).—The physiol. action of the atropine series and the tropeines is referred to the chem. constitution of each of the compds. discussed. The common assertion that the only tropeines showing strong mydriasis are those contg. in combination with the tropeine residue (a) a benzene ring and (b) an alc. hydroxyl group is not by any means true. The basic substance homotropine also gives rise to a series of compds. with mydriatic properties. Troylhomotropine is used in practice under the name "Mydriasin."

E. G. R. ARDAGH

The relation of adrenaline to the action of insulin upon the blood sugar content. F. F. MUELLER, M. J. LEWIS AND C. N. MYERS. *Proc. Soc. Exptl. Biol. Med.* 22, 142-6 (1924).—Rabbits were given injections of insulin 0.5 unit per kg. of body wt. and 0.1 cc. of 1:1000 soln. of adrenaline, separately and synchronously, and the blood sugar was detd. at 2-hr. intervals. The results were irregular; the double injection indicated a delayed insulin effect and not a neutralization.

C. V. B.

The effect of insulin on the morphological blood picture. V. E. LEVINE AND J. J. KOLARS. *Proc. Soc. Exptl. Biol. Med.* 22, 169-70 (1924).—Insulin injections in rabbits caused an increase in red cells, white cells and in viscosity indicating anhydremia. The changes were proportionate to the fall in blood sugar and not to the dose of insulin.

C. V. B.

Acetylation as a physiologic reaction. C. P. SHERWIN. *Proc. Soc. Exptl. Biol. Med.* 22, 182 (1924).—*p*-Aminophenylacetic acid was detoxicated in man by acetylation of the amino group. When fed to rabbits along with acetic acid, *p*-acetylamino phenylacetic acid was excreted in the urine. Detoxication in the dog was accomplished by combining with glycocoll. *o*-, *m*- and *p*-Aminobenzoic acids were excreted unchanged by the dog. Man and rabbit acetylated *m*- and *p*-aminobenzoic acids. *o*-Acetylamino benzoic acid was nontoxic to all test subjects and was excreted unchanged. Glycocoll did not act as a detoxicating agent in man.

C. V. B.

Action of chloral hydrate on the proteins of blood serum. M. NEŠKOVIĆ. *Glas Acad. Sci. Belgrade* 113, 27-40 (1924).—A 2.5% soln. of chloral hydrate ppts. the proteins of blood serum even in a diln. of 1:10,000. The pptn., which usually is not complete, is due to the dehydrating action of the chloral hydrate on the proteins and is more strongly marked with the globulins than with the albumins.

B. C. A.

The technic of administering ions in neoplastic diseases. A. SLOSSE AND R. REDING. *Bull. acad. roy. med. Belg.* [5], 5, 166-72 (1925).—The authors have shown in a previous publication (*C. A.* 19, 533) that cancer is a humoral disease and that the tumor only expresses the reaction of the diseased organism superimposed upon a local irritation. This was indicated, one, by the fact that the salt metabolism (or salt content) of the organism could be changed exptly. by injecting body-foreign salts like Mg, Cu, or Pb salts, two, by the fact that a change, thus brought about, was found to influence the development of the tumor both in exptl. tar cancer in mice and also in spontaneous human cancer (hopeless cases). In the present communication the dosage and mode of administration of Mg, Cu and Pb salts in human cancer are given. Mg salts are preferably injected intramuscularly as a 20% MgSO₄ soln., 10 g. of salt 4 or 5 times weekly in the beginning, later 4 g. every fourth day. 0.015 g. of novocaine and 1 mg. of adrenaline should be added to the soln. to make the injection painless and also, because the adrenaline reinforces the action of the Mg. MgSO₄ may also be administered intravenously (dose 2 g.) or by means of elec. cataphoresis (ionic medication)

neither of which methods offers advantage. *Copper salts* must be injected intravenously, dose 20 cc. of a 3 per mille soln. in a series of 10 injections, 2 or 3 times weekly. The use of *lead salts* requires some precautions in order to avoid grave intoxication. The first symptom of intoxication is the presence of granulated red cells (stippling). The total quantity of urine in 24 hrs. should be watched; diminution of this indicates nephritis, usually preceding albuminuria. Lead salts act promptly especially in some cases of sarcoma (cf. also Blair Bell, *Lancet* 1922, 11, 1005). The doses of lead salts are: 20 cc. of a 1 per mille lead acetate soln., injected intravenously, every fourth day. After having given this dose 3 times, it should be diminished to 10 cc., later on to 5 cc. Lead can also be administered in a 0.4% colloidal soln. (manufd. by the Laboratoire Couturieux, Paris) the initial dose of this being 40 cc. Lead salts can also be administered preferably by means of the elec. current, as ionic medication, 10 milliamperes passing through the body and a lead soln. for $\frac{1}{2}$ hr. The authors claim that they have succeeded by means of this treatment in curing perfectly 10% of their cancer cases, no recurrence having been observed for 2 years so far; in 45% of all cases a more or less transitory improvement was seen. All cancer cases, treated, had been entirely given up by surgery and radiation treatment as the tumor had begun to metastasize freely. The malignant character of the disease was verified in each case by an expert pathologist and by various clinicians. About 100 cases have been treated. R. BEUTNER

The influence of insulin on blood lactic acid. J. A. COLLAZO AND C. LEWICKI. *Biochem. Z.* 158, 136-43 (1925).—No correlation could be found between the fall of blood sugar and changes in the blood lactic acid following insulin injection. After 24 hrs.' starvation injection of a moderate dose of insulin caused some rise in lactic acid.

F. A. CAJORI

Treatment of sprue with calcium and parathyroid extract. F. D. BANA. *Brit. Med. J.* 1925, I, 111-2.—Partially successful treatment in 1 case. A. T. CAMERON

Creosote in influenzal pneumonia, chronic influenza, and encephalitis lethargica. R. R. WADE. *Brit. Med. J.* 1925, I, 158.—Good results are claimed in the first 2 conditions. A. T. CAMERON

Arsenical poisoning treated by sodium thiosulfate. HILDA M. HALLIDAY AND C. E. SUTHERLAND. *Brit. Med. J.* 1925, I, 407. Cf. Semon, *C. A.* 18, 2752. Successful results using intravenous injections of pure $\text{Na}_2\text{S}_2\text{O}_3$. A. T. CAMERON

Bismuth treatment of cerebrospinal syphilis. W. A. SMITH AND L. J. FOSTER. *J. Nervous Mental Diseases* 62, 113-8 (1925).—Good results with intramuscular injections of metallic Bi. A. T. CAMERON

The clinical use of sodium tetraiodophenolphthalein in cholecystography. G. MILLIKEN AND L. R. WHITAKER. *Surgery, Gynecol., Obstetrics* 40, 646-53 (1925).—It is considered safe and satisfactory. A. T. CAMERON

The oral administration of sodium tetraiodophenolphthalein for cholecystography. L. R. WHITAKER, G. MILLIKEN AND E. C. VOGT. *Surgery, Gynecol., Obstetrics* 40, 847-52 (1925).—Pills coated with salol in sirup of Tolu are satisfactory. A. T. C.

The effect of alcohols on the sensitive motor cortical centers of the dog. UGO BANDERATI. *Atti accad. Lincei* [5], 33, ii, 201-2 (1924); *Chem. Zentr.* 1925, I, 545.—One % strychnine soln. was applied to the exposed cortical tissues of the brain of dogs according to the method of Baglioni and Amantea. After the spasm became visible the strychnine application was removed and to the area which had been treated was applied a compress of various alcs. MeOH, EtOH, PrOH, iso-BuOH, AmOH, allyl alc. and capryl alc. had a temporary depressing influence. After removal of the alc. compress the spasm reappeared, though in a milder form. In exptl. epilepsy in dogs, daily subcutaneous injections of 1 cc. of EtOH per kg. continued for 1 week caused a slight increase in the condition and in more advanced cases had an antiepileptic action. The action of alc. must accordingly be indirect, the character of which is still unexplained. C. C. DAVIS

The effect of strychnine on the continuation of the life of prepared nerve centers. CARLO MANNELLA. *Atti accad. Lincei* [5], 33, ii, 204-5 (1924); *Chem. Zentr.* 1925, I, 546; cf. preceding abstr.—The duration of life, judged by visible reflex movements, of the nerve centers of the *Bufo vulgaris*, prepd. by the method of Baglioni, was detd. Application of 0.5% strychnine nitrate soln. in general prolonged the life. C. C. DAVIS

The effect of ethyl alcohol on the continuation of life of prepared nerve centers. CARLO PECTACCI. *Atti accad. Lincei* [5], 33, ii, 205-6 (1924); *Chem. Zentr.* 1925, I, 546; cf. preceding abstr.—When prepd. nerve centers of the *Bufo vulgaris* were kept in NaCl soln. and 0.1-0.4% EtOH, no marked effect was manifest. The life of the prepd. centers apparently decreased with increase in the EtOH and decrease in the NaOH

concn. A relatively long life resulted when the centers were kept in 0.5% NaCl soln. and then in 1% EtOH. Directly after the passage from the NaCl to the EtOH the reflex activity increased, which then decreased rapidly to the normal or gradually to complete inactivity. C. C. DAVIS.

The direct effect of strychnine and various alcohols on the prepared nerve center. PALMIRA TAVOLARO. *Atti accad. Lincei* [5], 33, ii, 206-8(1924); *Chem. Zentr.* 1925, I, 546; cf. preceding abstr.—Direct application of MeOH, EtOH, PrOH, *iso*-BuOH and capryl alc. on the surface of the posterior intumescencia of the prep. nerve center of *Bufo vulgaris* has a depressing effect which at times was sufficient to cause complete loss of sensitivity of the center, especially with preps. which had previously been treated with strychnine. This loss of sensitivity disappeared slowly a few hrs. after the application. The life of normal centers and of those treated with strychnine were prolonged by MeOH, EtOH, PrOH and *iso*-BuOH and shortened by allyl alc. and by capryl alc. C. C. DAVIS.

Studies of the toxicity of non-protein substances containing nitrogen in the blood serum of animals. YUHEI FUJIMORI. *Mitt. Med. Fak. Kais. Univ. Tokyo* 30, 207-67; *Chem. Zentr.* 1925, I, 1094.—Following the Fe method of Michaelis and Rona as modified by Hatta, 0.8 g. of protein-free substance contg. N was obtained from 1 l. of horse serum. It was sol. in EtOH, insol. in Et₂O and had an ash of 4.6%. A 10-20% soln. prep. from physiol. NaCl soln. caused dilation of the blood vessels, a decrease of blood pressure, stimulation of respiration and manifold phenomena of stimulation and paralysis of the central nervous system of rabbits and dogs. Death occurred with mice and frogs on account of cessation of respiration, but there was no injury to the kidneys or symptoms of uremia. The substance obtained by the same method from the blood of dogs with nephritis caused by U did not lower the blood pressure, but caused the same symptoms otherwise. In further expts. acidified serum was coagulated by heat and the protein obtained by filtering after addn. of kaolin, parallel expts. being run with serum from normal animals and from those with nephritis caused by U and by cantharides. The ratio residual N/ammoniacal N was 72:1 in serum from normal animals and was 24:1 in that from animals with nephritis caused by U and by cantharides. These last products obtained increased the blood pressure of rabbits and caused spasms, the effects apparently being due to NH₃, for (NH₄)₂CO₃ acted in a similar manner. C. C. DAVIS.

Urine analysis (effect of iodide ingestion). D. RAQUET AND M. PAGET. *Repert. pharm.* 36, 195-6(1925).—A sample of urine analyzed via the Haycraft-Deniges method gave unusually high values for the purine bases, because of previous ingestion by the patient of iodides. W. O. E.

The radioactivity of quinine, its antimalarial action. R. COMENGE GERPE. *Siglo Med.* 73, 411-4(1924); *Physiol. Abstracts* 10, 59.—Quinine is said to be radioactive, and is believed first to excite and then destroy cellular activity; it is much more radioactive if dehydrated. H. G.

Cardiac and diuretic action of squill. B. JOZ. *J. méd. Bordeaux* 24, 1014-5 (1924); *Physiol. Abstracts* 10, 57.—The cryst. glucoside isolated from squill is a cardiac tonic and diuretic. It slows sinus rhythm and increases the force of systole and it is recommended for conditions in which digitalis has lost its efficacy. H. G.

The effect of phenobarbital (luminal) on blood pressure in arterial hypertension. III. C. M. GRUBER, H. M. SHACKELFORD AND A. M. ECKLUND. *Arch. Intern. Med.* 36, 366-81(1925).—Phenobarbital diminished the arterial blood pressure in 85% of the cases of hypertension, both hospital and ambulatory, in which it was used, but it appeared to become less and less effective as its administration was prolonged beyond a month or more, although some cases were benefited by its use for 7 or 8 months. In moderate doses it appears to have no injurious action on the kidneys. With the fall in blood pressure, the rate of phenolsulfonephthalein excretion is usually increased but, in some instances, is diminished. The rate of excretion returns to its original level after withdrawal of the drug. I. GREENWALD.

Action of iodine. HERMANN EPHRAIM. *Klin. Wochschr.* 3, 1402-3(1924).—Administration of iodides enhances the rate of sedimentation of the red blood corpuscles. MILTON HANKE.

Changes in the composition of blood induced by a pharmacological stimulation of the vagus. K. DRESEL. *Klin. Wochschr.* 4, 1066-7(1925); cf. Vollmer, C. A. 19, 2705.—D. maintains that his original contentions are correct (cf. C. A. 17, 589). Corroborative research is included. MILTON HANKE.

Changes in blood chemistry produced by a pharmacological stimulation of the vagus. H. VOLLMER. *Klin. Wochschr.* 4, 1599(1925); cf. C. A. 19, 2705.—Answer to Dresel,

(cf. preceding abstr.). Merely a discussion of previous results. Vollmer and Dresel have obtained entirely contradictory results.

MILTON T. HANKE

The mass treatment for goiter. A. LILL. *Münch. med. Wochschr.* 71, 1791 (1924); *Bull. mens. office intern. hyg. publ.* 17, 304-5 (1925).—Würzburg in 1922-3 distributed I prophylaxis tablets weekly to the children with the consent of their parents. The first tablets contained 0.005 g. I, later ones 0.003 g. I. The latter dosage was ample. Forty doses were given in one year. After discontinuance of treatment for 1 yr. most of the children did not show thyroid increase. Considerable improvement had been noted.

JACK J. HINMAN, JR.

Action of radium on smallpox vaccine lymph. UMBERTO POPPI. *Rev. hyg.* 47, 308 (1925).—Glycerinized lymph was exposed to the rays from 0.1 g. Ra bromide. All saprophytic bacteria were killed by an 86 hr. exposure, with practically no diminution of specific activity. Longer exposure tends to attenuate the vaccine but a good degree of immunity is conferred by the exposed lymph. Encouraging, but not definite results.

JACK J. HINMAN, JR.

The disinfection of tuberculous sputa by chloramine (Tochlosine, Poulenc). F. CARRIEU AND P. BOULOUYS. *Rev. hyg.* 47, 514-27 (1925).—Five % soln. of the chloramine in equal vol. to the sputum is effective as shown by animal inoculation.

JACK J. HINMAN, JR.

Yatren treatment of amebiasis. W. F. BAX. *Geneeskund. Tijdschr. Nederland. Indie* 65, 13-8 (1925); cf. *C. A.* 19, 1161.—Yatren is preferable to emetine on account of its lower toxicity, but cannot replace it in all cases.

MARY JACOBSEN

The every fourth day dosage of quinine in malaria. A. NICOLAI. *Geneeskund. Tijdschr. Nederland. Indie* 65, 51-4 (1925); cf. Ziemann, *Arch. Schiffs-Tropen. Hyg.* 1904.—Ziemann's method based on Mariani's observation that quinine is detectable in urine 3 days after administration is of no prophylactic value. It prevents relapses only in a small percentage of cases and has some beneficial effect after it has been discontinued.

MARY JACOBSEN

Pyoctyanin as an antiseptic. J. C. J. C. SMITS. *Geneeskundig Tijdschr. Nederland. Indie* 65, 340-4 (1925).—Pyoctyanin is superior to other dyes and dye mixts. as an antiseptic and deodorant in all cases of profuse suppuration. It is equally active against strepto- and staphylococci and rapidly excreted. Depot formation and necrotization reported by other authors were never observed by S. Unlike $HgCl_2$ and CHI_3 it never gives rise to eczema in the tropics. Purity is essential. Merck's prepn. was used with good result.

MARY JACOBSEN

Thymol in the treatment of leprosy. H. HEINEMANN. *Geneeskund. Tijdschr. Nederland. Indie* 65, 66-9 (1925); *Arch. Schiffs- u. Tropen-Hyg.* 28, 523 (1924); *Bull. mens. office. intern. hyg. publ.* 17, 700 (1925).—Heyden's prepn. 651a contg. a 1% thymol emulsion gave good results when injected intravenously every 2nd day in doses increasing from 0.2 to 0.8 cc. The injections are painless and free from untoward effects. Pulmonary tuberculosis was neither aggravated nor favorably influenced.

M. J.

Magnesium sulfate in the cure of tetany. ATTILIO EMMANUELE. *Pediatrics* 33, 632-41 (1925).—Good results are obtained in all cases of spasmodophilia.

M. J.

The lactagog action of yohimbine. GIOVANNI CARTA. *Pediatrics* 33, 715-7 (1925).—From 4 to 7 injections (daily) of 1 mg. yohimbine had in 6 cases an excellent lactagog effect lasting 41-137 days and free from untoward effects.

M. J.

The influence of adrenaline on the blood picture of the new-born. CARMINE GALLO. *Pediatrics* 33, 739-50 (1925).—Adrenaline causes in the new-born peripheral leucocytosis which, however, never reaches the degree encountered in adults and nurslings. The increase is attributable to the influence of adrenaline on the peripheral vessels rather than to stimulation of the hematopoietic system. This effect is subject to individual variations depending on the individual sensitiveness to adrenaline. The latter is lower in the new-born perhaps on account of his vagotonic equilibrium.

M. J.

Hypophysin in enuresis. LINA BACCORSI. *Pediatrics* 33, 936-42 (1925).—Intramuscular injections mostly give permanent or transient relief, sometimes better growth. Oral administration is useless.

MARY JACOBSEN

Administration of mercurial preparations in leprosy (I). *Mercurochrome soluble* 220. O. F. DENNEY, RALPH HOPKINS, JERALD G. WOOLEY AND BOYD G. BARENTINE. *U. S. Public Health Repts.* 40, 1795-808 (1925).—*Mercurochrome sol.* 220 is not a specific for leprosy. It has been helpful in checking rapid retrogression and in healing neurotrophic ulcers and those resulting from disintegrating tubercles. Pulmonary tuberculosis was aggravated.

MARY JACOBSEN

The influence of fructose on blood clotting. E. SLUITER. *Verslag Akad. Wetenschappen Amsterdam* 34, 486-8 (1925).—Unlike glucose, maltose, lactose and saccharose

fructose causes clotting of citrated or phosphated whole blood or plasma, the time of clotting being inversely proportional to the concn. or quantity of fructose. Blood laked by oxalate, $MgSO_4$, or defibrination is not influenced. Expts. with a fibrinogen soln. in suitably varied combinations with H_2O , Ringer soln., citrate and fructose showed that besides Ringer soln. only the combination Ringer-citrate-fructose caused clotting. Apparently fructose sets Ca^{++} free from complex compds. Ca compds of fructose are known. Exptl. proof is furnished by CaC_2O_4 pptn. from citrate or metaphosphate solns. after the addn. of fructose.

MARY JACOBSEN

The biochemistry of glands. III. Influence of heat radiation on blood reaction, alkali reserve and mineral constituents. C. KROETZ. *Biochem. Z.* 153, 165-72 (1924); cf. C. A. 19, 3117.—Normal men were subjected to heat and light baths.

protein and $NaCl$ leaves the blood and goes to the tissues. In comparison with irradiation with ultra-violet light and Röntgen rays, no initial acidosis or anion deficit, or change in ratio of ions occurs. The source of the alkalosis is not explained. W. D. L.

The physiology of glands. L. ASHER. LXXI. The relation between thyroid and suprarenals proved by the respiratory metabolism. K. NAKAYAMA. *Biochem. Z.* 155, 387-412 (1925); cf. C. A. 19, 1883, 3106.—Normal rats show an increased respiratory exchange upon being injected with adrenaline, but thyroidectomized rats show a much smaller increase. Feeding thyroid tablets to both groups increased the respiratory exchange with adrenaline. The thyroid secretion is an activator of the parasympathetic and sympathetic nervous system. LXXII. The influence of the suprarenals upon the respiratory exchange. *Ibid.* 413-35.—Removal of both suprarenals hardly changes the respiratory exchange of rats, even after feeding carbohydrates. Feeding of thyroid leaves the carbohydrate metabolism of normal and thyroidectomized rats unchanged. LXXIII. Effect of thyroid and spleen extirpation upon the respiratory exchange as influenced by injection of adrenaline. *Ibid.* 436-58.—The effect of adrenaline upon the respiratory exchange is noted as above.

W. D. LANGLEY

The effects of changes in hydrogen-ion concentration on the blood flow of morphinized dogs. T. R. HARRISON, C. P. WILSON and A. BLALOCK. *J. Clin. Invest.* 1, 547-68 (1925).—Acidosis caused by intravenous injection of acids was associated with increased circulatory minute vol. and hyperpnea. O_2 consumption did not increase enough to account for the high vol. flow as part of the increased work of breathing. Alkalosis had the opposite effect on the minute vol. flow and respiration. The variation in H-ion concn. is given as the cause of these variations in blood flow, because the latter was increased just as much when acidosis was associated with low CO_2 as with high CO_2 . The pulse rate paralleled the O_2 consumption much more closely than it did the blood flow.

LOUIS LEITER

Insulin and the mechanism of hibernation. G. J. CASSIDY, S. DWORKIN and W. H. PINNEY. *Am. J. Physiol.* 73, 417-28 (1925).—Cats and dogs can be put into a condition simulating hibernation by the combined action of insulin and lowered body temp. (25°). At this temp. insulin abolished the shivering reflex, which reappears on the administration of glucose.

J. F. LYMAN

The action of insulin on the blood, with special reference to the cause of the condition known as hypoglycemia. LEE FOSHAY. *Am. J. Physiol.* 73, 470-9 (1925).—Symptoms of distress and convulsions were noted after insulin administration in which the sugar content of the whole blood was still above normal values. The sugar content of the corpuscles is reduced by insulin disproportionately to that of the whole blood and it is this condition, reduced cellular sugar, rather than the sugar content of the blood serum that dictates the symptoms of distress associated with hypoglycemia.

J. F. LYMAN

The direct action of insulin on fat metabolism. H. S. RAFFER and E. C. SMITH. *J. Physiol.* 60, 41-9 (1925).—In decerebrate cats, having low glycogen reserves, insulin causes hypoglycemia accompanied by a decrease of liver fat and an increase in blood and muscle fat.

J. F. LYMAN

The effect of pituitrin on the fatty acid of the liver. R. COOPE and E. N. CHAMBERLAIN. *J. Physiol.* 60, 69-78 (1925).—The injection of pituitrin into rats and rabbits caused a fatty infiltration of the liver suggesting that the pituitary hormone plays a part in the mobilization of depot fat. Insulin and the pituitrin "fat liver." R. COOPE. *Ibid.* 92-4.—A single dose of insulin given simultaneously with pituitrin profoundly modifies, and in many cases completely prevents, the pituitrin effect on liver fat.

J. F. LYMAN

The influence of the spleen in carbon monoxide poisoning. J. BARCROFT, C. D. MURRAY, D. ORAHOVATS, J. SANDS AND R. WEISS. *J. Physiol.* 60, 79-94(1925).—*See C. A.* 19, 1733. J. F. LYMAN

The relation of the thyroid gland to the action of insulin. J. H. BURN AND H. P. MARKS. *J. Physiol.* 60, 131-41(1925); cf. *C. A.* 18, 3645.—The thyroid hormone caused the liberation of sugar from the glycogen of the liver which antagonizes the hypoglycemia produced by an excess of insulin in the circulation. J. F. LYMAN

The effects of insulin upon sugar utilization in muscle. C. G. LAMBIE. *Proc. Physiol. Soc., J. Physiol.* 60, xxiii(1925).—When glucose was injected into a decerebrate cat, the rate of injection had to be increased 75 to 100% after 10 units of insulin in order to maintain a uniform blood sugar level. J. F. LYMAN

The influence of insulin on the blood sugar curve in diabetics after the administration of glucose, with special reference to the activity of the peripheral tissues. KAREN MARIE HANSEN AND HARALD RØNLUND. *Acta med. Scand.* 62, 213-34(1925).—When the rise in the arterial and venous blood sugar curve in diabetics after feeding a definite amt. of glucose is compared with and without a previous administration of insulin ($\frac{1}{2}$, 1 and 2 hrs. before feeding the glucose) no definite difference between them can be detected. The effect of an adequate dose of insulin is to decrease the one-gm rise in the smooth arterial blood curve. S. MORGULIS

Therapeutic application of oil emulsions of insulin. ERIK HEDVALL. *Acta med. Scand.* 62, 334-60(1925).—Oil emulsions of insulin injected intramuscularly or subcutaneously are absorbed more slowly and exert an action over a longer period than insulin in any other form. It is, therefore, possible to bring about results with a single daily injection where otherwise 2 or more might be necessary. Besides, there is not the same danger of producing hypoglycemia with larger doses as is present in the other methods. S. MORGULIS

The use of small doses of quinine as a means of reducing the virus reservoir in paludism of the natives. H. FOLEY AND M. BROUARD. *Compt. rend. soc. biol.* 92, 859-61(1925).—Quinine sulfate is very useful as a preventive of malaria especially with small children. S. MORGULIS

Poisoning with grains of *Cassia occidentalis* L. is due to a toxic albumin. RAYMOND MOUSSU. *Compt. rend. soc. biol.* 92, 862-3(1925).—*Cassia occidentalis* is shown to contain a toxic albumin which can be detoxicated entirely or partly through the action of formol. This albumin also behaves as an antigen, and it is possible to immunize dogs against it by repeated subcutaneous injections. S. MORGULIS

Effect of insulin on the rate of sedimentation of the red cells in horses. C. E. PICO, C. FRANCESCHI AND J. NEGRETE. *Compt. rend. soc. biol.* 92, 907-8(1925).—The results of this study were not sufficiently const. to permit any definite conclusion. But it has been observed that horses with a high sedimentation rate before insulin treatment also suffer a much more severe hypoglycemia than those with a low sedimentation rate, when they are injected with insulin. S. MORGULIS

Comparative effect of prolonged treatment with small doses of quinine on *Plasmodium praecox* and *Pl. vivax* in indigenous carriers of the germs. H. FOLEY AND M. BROUARD. *Compt. rend. soc. biol.* 92, 958-60(1925). S. MORGULIS

Chloroform and adrenaline. Experimental reanimation of the heart. E. BARDIER AND A. STILLMUNKES. *Compt. rend. soc. biol.* 92, 1048-50(1925).—Intra-cardiac injection of adrenaline in strongly chloroformed dogs whose hearts are beating very slowly and irregularly at the moment of death may cause momentarily reanimation. But frequently the adrenaline- CHCl_3 syncope occurs at the same time after the injection. The adrenaline injection is ineffective if it coincides with the period of cardiac fibrillation or follows its onset. S. MORGULIS

Effect of quinine on the diphtheria toxin. PAUL NÉLIS. *Compt. rend. soc. biol.* 92, 1116-9(1925).—Salts of quinine display an anti-toxic property against diphtheria toxin. S. MORGULIS

The effect of small and of large doses of adrenaline on the motility of the small intestines in man. D. DIANÉLOPOLU, D. SIMICI AND C. DIMITRIU. *Compt. rend. soc. biol.* 92, 1146-8(1925).—Small doses of adrenaline (1 cc. of 1/300.000-1/900.000 intravenously) cause increased peristaltic contraction, while stronger doses cause inhibition of contractility. S. MORGULIS

Causes of error in the investigation of the glucuronic acid of urine. M. BRULÉ, H. GARBAN AND A. AMER. *Compt. rend. soc. biol.* 92, 1216-8(1925).—A number of conditions are pointed out which interfere with the reaction for glucuronic acid. Medication with urotropine has been found to annul the reaction and thus lead to erroneous conclusions. S. MORGULIS

Effect of atropine on the cardio-inhibitory apparatus. A. AND B. CHAUCHARD. *Compt. rend. soc. biol.* 92, 1226-8(1925). S. MORGULIS

Hydrogen sulfide and sodium sulfide in mercuric chloride intoxication. S. F. GOMES DA COSTA. *Compt. rend. soc. biol.* 92, 1241-4(1925).—Expts. on guinea pigs, mice and dogs poisoned with HgCl_2 given either hypodermically or by way of the stomach show that there is no protective action afforded by treatment (subcutaneous, *per os* or *per rectum*) with either H_2S or Na_2S . S. MORGULIS

Local effect of strychnine on nerves and nerve centers. FRÉDÉRIC BREMER AND PIERRE RYLANT. *Compt. rend. soc. biol.* 92, 1329-31(1925); cf. C. A. 19, 1904.—Expts. with the application of strychnine either to motor nerves *in situ* or to the spinal cord show by the alteration in chronaxie that the effects are due to a direct action of the poison on nerve protoplasm. **Modification by strychnine of the electromyogram of the flexion reflex.** *Ibid* 1331-5(1925). S. MORGULIS

Origin of adrenaline. R. ARNOLD AND P. GLEY. *Compt. rend. soc. biol.* 92, 1413-4(1925).—Tyrosine, phenylalanine, dihydroxyphenylalanine, tyramine and inositol have no effect on the production of adrenaline by the adrenal glands. **Reinforcement of the vasoconstrictor effect of adrenaline by creatine and creatinine.** *Ibid* 1415-6(1925).—The addn. of creatine or creatinine does apparently cause an increased effect of adrenaline. S. MORGULIS

Toxicity of corynanthine. RAYMOND HAMET. *Compt. rend. soc. biol.* 92, 1420-2(1925).—This alkaloid is extd. from *Pseudocinchona africana*. Its toxic symptoms are analogous to those of yohimbine. Doses up to 151 mg. per kg. of guinea pig were ineffective, but all doses above 161 mg. were fatal. Within 30 min. to 2 hrs. after subcutaneous injection paresis develops which extends posteriorly. There is increased salivation and death follows from true respiratory paralysis. S. MORGULIS

The effect of certain cations on the amebocytes of *Arenicola* studied in vitro. F. FAURÉ-FREMIET. *Compt. rend. soc. biol.* 92, 1436-8(1925). S. MORGULIS

The effect of the poison of *Adamsia palliata* on the muscles of *Carcinus moenas*. N. L. COSMOVICI. *Compt. rend. soc. biol.* 92, 1230-2(1925).—The poison produced by *Adamsia* acts directly on the muscle substance. S. MORGULIS

The convulsive action of the poison from *Adamsia palliata* on *Carcinus moenas*. N. L. COSMOVICI. *Compt. rend. soc. biol.* 92, 1466-9(1925).—The poison of *Adamsia* has a convulsive effect on crabs. The animals die following a series of convulsions with their limbs drawn up to the thorax. They are completely paralyzed before death. **Autotomy in *Carcinus moenas* caused by the poison of *Adamsia palliata*.** *Ibid* 1469-70(1925). S. MORGULIS

The sensitivity of normal and depancreatized dogs towards insulin. L. KÉPINOW AND S. LEDEBT. *Compt. rend. soc. biol.* 93, 16-8(1925).—The same degree of hypoglycemia can be produced in a depancreatized dog with about 0.1 the insulin dose required for a similar effect in normal dogs. In depancreatized dogs the lowering of the blood sugar per unit of insulin obtains a remarkable constancy. S. MORGULIS

Contribution to the study of the action of scorpion venom. OCTAVIO DE MAGALHAES. *Compt. rend. soc. biol.* 93, 35-7, 42-4(1925).—The venom from 3 species of scorpion has been studied to det. the min. toxic dose. These tests have been made with 97 different kinds of organisms, including man. The venom does not keep well, though in the dry state it can be preserved better. Heating to 100° does not diminish the toxicity of the venom. In susceptible organisms no toxic effects are produced when the venom is given by mouth or *per rectum*. The intensity of the effect diminishes according to the mode of administration in the following order: intracerebral intracardiac > intravenous > intraperitoneal > intramuscular > subcutaneous. The scorpion venom is a poison of the nervous system. It is not readily absorbed and even 2-5 min. after inoculation with several times the lethal dose it is possible to save the organism by eliminating the inoculated part. Animals without a differentiated nervous system cannot be poisoned, except, for young *Tatus novemcinctus*; the adult is immune to the venom. Absolute immunity to the scorpion poison is only obtained when the central nervous system is immunized. Various animals have a certain degree of acquired immunity. A specific antiscorpion venom serum can be prepd. by injecting horses or sheep intravenously. The leaf and tube of *Dahlia* has a slight neutralizing effect on the scorpion venom. Tyrosine also has a definite antitoxic effect. The venom is not neutralized *in vitro* by nervous tissue. S. MORGULIS

Death due to inhibition. HENRI DE WAELE. *Compt. rend. soc. biol.* 93, 60-1(1925).—Electrical stimulation of the vagus causes arrest of the heart beat for only a brief period, the heart regaining its activity in spite of prolongation of the stimulus. On the contrary, various substances which act upon the peripheral terminations of the

vagus easily cause death through cardiac inhibition. Thus, CaCl_2 or BaCl_2 , anesthetics, protein (primary shock phase) and also Ca salts plus peptone, or peptone plus pituitrin, histamine and adrenaline may all cause death and this effect is promoted by acidosis and is opposed by alkalosis. The administration of bicarbonates to nervous patients requiring anesthesia is thus very desirable. S. MORGULIS

Effect of antipyrine on diabetics. F. RATHERY AND R. KOPRILSKY. *Compt. rend. soc. biol.* 93, 102-4 (1925).—In one series of expts. the urinary and blood sugar detns. were made after patients had ingested large doses of antipyrine for several days. There was a lowering of the excretion of free sugar in the urine and a rise in the "protein sugar." In a second series with the same patients the detns. were made immediately after antipyrine was administered. In these patients there was a lowering of the urinary sugar even after 1 hr., but the original level was reestablished after 24 hrs. Antipyrine, therefore, appears to have a transitory effect. The lowering of the blood sugar is more marked. The diminished sugar excretion is due neither to a blocking of the kidney nor to an increased glucolysis. Its therapeutic use is not considered advisable. S. MORGULIS

A preliminary intravenous injection of adrenaline does not prevent the danger of an adrenaline-chloroform syncope. A. TOURNADE AND J. MALMEJAC. *Compt. rend. soc. biol.* 93, 114-5 (1925). S. MORGULIS

Depressing action of cocainization of the medulla on physiological adrenaline secretion and adrenalinemia. A. TOURNADE, M. CHABROL AND P. E. WAGNER. *Compt. rend. soc. biol.* 93, 160-1 (1925). S. MORGULIS

Effect of calcium chloride and sodium citrate on the thrombocyte and leucocyte content of the blood. E. L. BACKMAN, G. EDSTRÖM, E. GRAHNS AND G. HULTGREN. *Compt. rend. soc. biol.* 93, 183-6 (1925).— CaCl_2 and Na citrate both produce a transitory diminution in the number of thrombocytes. CaCl_2 causes a transitory leucocytosis, while the Na citrate causes a great diminution of the leucocytes. **Effect of adrenaline, histamine and nicotine on the number of thrombocytes and leucocytes in the rabbit blood.** *Ibid* 186-9.—Adrenaline produces thrombocytosis. **Effect of acetylcholine, pilocarpine and atropine on the number of thrombocytes and leucocytes in the rabbit blood.** *Ibid* 190-3. S. MORGULIS

Importance of some guanidine derivatives on the vasomotor effect of adrenaline. C. A. BRODD. *Compt. rend. soc. biol.* 93, 203-7 (1925).—Arginine in the concn. of 0.03% greatly increases the vasoconstrictor effect of a 0.0001% adrenaline soln. Creatine likewise reinforces the action of adrenaline, while creatinine has no effect. S. M.

Effect of dimethylguanidine on the blood vessels. TOR ENGLUND. *Compt. rend. soc. biol.* 93, 207-10 (1925).—Dimethylguanidine is a vasoconstrictor substance; it depends upon the presence of a sufficient concn. of Ca ions for its action. In the absence of Ca ions it may cause vasodilatation. Increasing the Ca concn. causes a greater and more prolonged vasoconstrictor effect. Atropine does not modify the action of the dimethylguanidine. Ergotamine transforms it into a vasodilator substance. Dimethylguanidine acts on the terminal motor organs of the sympathetic as well as directly on the smooth muscle. Atropinization in the absence of Ca restores to the dimethylguanidine its constrictor power. S. MORGULIS

Effect of bile and of bile salts on neuromuscular excitability. LOUIS LYON-CAEN. *Compt. rend. soc. biol.* 93, 237-40 (1925).—Bile and bile salts belong in the category of curare-like poisons which prolong the chronaxie of muscle but not of nerve. They are rapidly acting poisons, affecting much more violently the slowly acting muscles than the quickly acting ones. S. MORGULIS

The action of pituitrin. G. MARTINESCU AND G. POPOVICIU. *Compt. rend. soc. biol.* 93, 250-2 (1925). S. MORGULIS

Effect of various pharmacodynamic agents on the color of *Leptodactylus ocellatus*. B. A. HOUSSEY AND J. UNGAR. *Compt. rend. soc. biol.* 93, 253-5 (1925). S. M.

New studies of the chloroform content of the nervous system during anesthesia; determination of the anesthetic in the sympathetic ganglia. MAURICE NICLOUX AND A. YOVANOVITCH. *Compt. rend. soc. biol.* 93, 272-4 (1925); cf. C. A. 19, 1455.—When CHCl_3 is administered for a brief time without actually causing anesthesia the brain fixes more CHCl_3 than the peripheral nerves, but once anesthesia is produced the peripheral nervous system accumulates more of the anesthetic than the central nervous system. The isolated vagus nerve (with its blood supply intact) takes up as much CHCl_3 as the non-isolated nerve. When CHCl_3 is given together with morphine the CHCl_3 content of all parts of the nervous system is lowered. Sympathetic ganglia fix as much CHCl_3 as the vagus, but more than the brachial or sciatic nerve. S. MORGULIS

Partition of arsenic in placenta injections of novarsenobenzene, L. H. DE-

JUST AND H. VIGNES. *Compt. rend. soc. biol.* 93, 314-5(1925).—The As content is much greater in the fetal than in the maternal portion of the placenta. S. M.

Effect of nitroglycerin and of amyl nitrite on venous tension. L. PAYAN AND ED. GIRAUD. *Compt. rend. soc. biol.* 93, 351-3(1925).—Both drugs give good results in cases of hypertension by relieving the work of the ventricles through vasodilatation. S. MORGULIS

Effect of sparteine on the cardiovascular mechanism of the dog. FERNAUD MERCIER AND L. J. MERCIER. *Compt. rend. soc. biol.* 93, 338-40(1925).—Sparteine sulfate in doses of 5-10 mg. per kg. has the following effects on the dog: the amplitude of the cardiac contractions is increased without loss of energy of the myocardium, but there is no durable lowering of the arterial pressure and slowing up of the cardiac rhythm. S. MORGULIS

Effect of sparteine on the cardiovascular mechanism of the dog. FERNAND MERCIER AND L. J. MERCIER. *Compt. rend. soc. biol.* 93, 412(1925); cf. preceding abstr.—Correction to an earlier paper: An intravenous injection of 0.005-0.01 mg. sparteine sulfate may produce either a quick, transitory hypertension, a slight hypotension which varies according to the rate of the injection, or it may cause no alteration in arterial pressure. S. MORGULIS

Vaso-constrictive action of broom. H. BUSQUET AND CH. VISCHNIAC. *Compt. rend. soc. biol.* 93, 419-21(1925).—Broom causes a strong vasoconstriction due to a direct stimulation of the vein wall. S. MORGULIS

Acute involution of the thymus produced by alcohol injections. J. JOLLY. *Compt. rend. soc. biol.* 93, 478-80(1925). S. MORGULIS

Effect of inhaling mercury and arsenic vapors. P. POINCELOUX. *Compt. rend. soc. biol.* 93, 487-9(1925).—Pulmonary inhalation of the vapors of Hg or As have definite spirocheticidal and trypanosomocidal effects. In trypanosomal disease, however, death is caused by As poisoning if the treatment is persisted in. S. M.

Effect of tropine base on the secretion of the submaxillary gland. RÉNE HAZARD AND L. J. MERCIER. *Compt. rend. soc. biol.* 93, 518-20(1925).—Tropine suppresses the salivary secretion just as atropine does. S. MORGULIS

Effect of basic bismuth acetoxyaminophenylarsenate on syphilis. L. POPOFF. *Compt. rend. soc. biol.* 93, 577-8(1925).—This compd. has an intense antisiphilic action in the primary and secondary phase of the disease and even in the disease of old standing. Treponemas disappear quickly; the Wassermann reaction becomes negative; and the lesions undergo cicatrization. S. MORGULIS

Effect of basic bismuth acetoxyaminophenylarsenate on experimental nagana and spirilliosis in chickens. S. NICOLAU, A. DOSKOCIL AND I. A. GALLOWAY. *Compt. rend. soc. biol.* 93, 580-2(1925).—This compd. has trypanocidal and spirillicidal action *in vivo*. S. MORGULIS

Curative action of basic bismuth acetoxyaminophenylarsenate in experimental syphilis. C. LEVADITI. *Compt. rend.* 180, 1971-2(1925).—The drug contains about 41% of Bi and 15% of As. Rabbits with lesions rich in treponemas or parasites were cured in 4 or 5 days by injections of a flocculent aq. suspension in a dose contg. 1.5 mg. of Bi per kg. of live wt. An oily suspension of the drug was efficient in doses contg. 0.041 g. per kg. live wt. The presence of a quantity of As associated with the Bi favors the curative action of the latter metal by augmenting its treponemicidal power and by exercising a tonic influence upon the organism which compensates for the debilitating action of the Bi. Curative action of basic bismuth acetoxyaminophenylarsenate in syphilis. L. FOURNIER AND A. SCHWARTZ. *Ibid* 1973-4. In 20 clinical cases the drug showed a strong curative action. With 6 of the patients the Bordet-Wassermann test was negative in a few days to a month after the cure. L. W. RIGGS

Treponemicidal action of gold and of platinum. C. LEVADITI, A. GIRAUD AND S. NICOLAS. *Compt. rend.* 181, 163-5(1925).—Tests with rabbits, having exptl. syphilis, proved that intravenous injections of 0.5 g. of the double hyposulfite of Au and Na (0.018 Au) per kg. of body wt. caused a disappearance of the spirochetes on the 2nd day. Doses of 0.02 or even 0.01 g. subcutaneously or 0.2 to 0.5 g. per kg. by the mouth were followed by curative action in 3 to 5 days. The double hyposulfite of Pt and Na injected subcutaneously, in doses contg. 0.015 to 0.03 g. per kg. had a curative action but less marked than that of the Au compd. The treponemicidal activity of Bi, Au and Pt are in the order named which is the decreasing order of their at. wts. L. W. R.

Preliminary note on the pharmacology and therapeutics of *Adhatoda vasica* (Basak). R. N. CHOPRA AND SUDHAMOY GHOSH. *Indian Med. Gaz.* 60, 354-5(1925).—Chemical analysis of this plant shows the presence of an alkaloid, vasicine $C_{11}H_{12}N_2O$, and of a volatile principle of the nature of an essence. Vasicine has no marked action on the

alimentary canal or on the circulation. It produces a slight but persistent bronchodilation in exptl. animals and this effect is increased after the administration of atropine. Clinically a fluid ext. prepd. from the leaves has expectorant properties and relieves bronchial spasm.

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G. H. SMITH

Mechanism of cooling and convulsion intoxications. **Nervous mechanism of lowered temperature.** F. ROSENTHAL, H. LICHT AND FR. LAUTERBACH. *Arch. exptl. Path.* **106**, 233-64(1925).—Despite the manifold resemblances between the clinical expression of acute insulin intoxication and the cooling and convulsion intoxications of Harnack the modes of action are very different. The characteristic hypoglucemia of acute insulin intoxication is lacking in the other conditions, indeed, there is a marked hyperglucemia, and the fall in temp. occurring in Harnack's cooling intoxication is of an entirely different origin from that of insulin intoxication. The hyperglucemia developing after picrotoxin, aconitine, and veratrine is due to central stimulation of the sympathetic. The hyperglucemia of cooling intoxication is not, like that of pique and other central hyperglucemias, associated with the reserves of glycogen, but occurs in a manner analogous to adrenaline hyperglucemia in phlorhizin-hunger animals. In the cooling action of picrotoxin, aconitine and veratrine there is both an increased loss in heat and a reduction in the heat formation. In the cooling associated with paralysis of the heat centers there is a greatly increased N output, but this does not take place during the cooling associated with picrotoxin intoxication, clearly indicating a different mechanism for the temp. fall. Ergotamine prevents the development of a hyperglucemia through the action of cold.

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Glycol esters of certain aromatic acids (CRETCHER, PITTINGER) 10.

I-ZOOLOGY

R. A. GORTNER

Hemocyanin. I. The dissociation curves of the oxyhemocyanin in the blood of some decapod Crustacea. ELLEN STEDMAN AND EDGAR STEDMAN. *Biochem. J.* 19, 544-51(1925).—The dissociation curves of the oxyhemocyanin present in the blood of *Maia*, *Palinurus*, *Cancer* and *Homarus* have been plotted from detns. of the O capacities of blood equilibrated with O at various tensions. The affinity of the hemocyanin for O is the same for all 4 species. The results show that hemocyanin is capable of exercising respiratory functions in a manner analogous to hemoglobin and suggest that the hemocyanins present in the species examd. are identical. BENJAMIN HARROW

Nature of the metabolic processes in *Ascaris lumbricoides*. W. K. STATER. *Biochem. J.* 19, 604-10(1925).—The worms are incapable of continuous movement in the absence of O. Only by avoiding movement are they able to live for long periods in atms. of inert gases. For their normal metabolism, the worms require a supply of O. BENJAMIN HARROW

Extractives of *Arbutia pustulosa*. FR. HOJTZ AND FR. THIELMANN. *Z. Biol.* 81, 296-8(1924).—The extractives isolated were adenine, as the picrate, $C_6H_5N_5 \cdot C_6H_2(NO_2)_3OH$, arginine, as the copper nitrate, $(C_6H_4N_4O_2)_2 \cdot Cu(NO_3)_2 \cdot 3H_2O$, and lysine, as the picrate, $C_6H_{14}N_2O_2 \cdot C_6H_2(NO_2)_3OH$. FRANCES KRASNOW

Chemical investigation of the sturgeon (*Acipenser sturio*). O. FLÖSSNER AND F. KUTSCHER. *Z. Biol.* 81, 305-8(1924).—From an ext. of the sturgeon lactic acid (Zn salt), xanthine ($AgNO_3$ compd.), methylguanidine (picrate, m. 192), choline (aurate, m. 238) and neosine (aurate, m. 247-8) were obtained. FRANCES KRASNOW

New experimental studies on the factors producing metamorphosis of the intestine in frog tadpoles. KAZIMIERZ SEMBRAT. *Compt. rend. soc. biol.* 92, 1004-6(1925). S. MORGULIS

Larval metabolism of insects. J. HELLER. *Compt. rend. soc. biol.* 92, 1006-8(1925).—In the metabolism of larvae are distinguished: (1) the stage of histolysis, the processes of tissue disintegration being accompanied by lowering of the respiratory exchange; (2) a stage of relative metabolic stability, and a high metabolic rate, the entire duration of this phase varying inversely as the temp; (3) a stage of constantly increasing metabolic activity, during which tissue reconstruction takes place. S. M.

Influence of the oxygen pressure on the metabolism of the larvae of *Salamandra maculosa*. L. DRASTICH. *Compt. rend. soc. biol.* 92, 1066-70(1925).—Exptl. evidence seems to point to the conclusion that when the partial pressure of O is too low complete oxidation becomes impossible even in the presence of an abundance of nutritive material. S. MORGULIS

Temperature coefficient of the X-ray action on *Ascaris* eggs. A. DOGNON. *Compt. rend. soc. biol.* 92, 1389-92(1925).—Within the limits of 17 to 40° a rise in temp. of 20° causes a 2-6-fold increase in the radiation effect. The temp. coeff. is much smaller with eggs which are radiated in the dry condition when the developmental activity is greatly diminished. Likewise, when the temp. is raised above 35°, the optimum for the egg activity, the coeff. diminishes. S. MORGULIS

Effect of development on hydrogen-ion concentration and on the oxidation-reduction potential in marine eggs, determined by the method of micro-injection. JOSEPH NEEDHAM AND DOROTHY M. NEEDHAM. *Compt. rend. soc. biol.* 93, 503-6(1925); cf. *C. A.* 19, 2832.—No change has been observed either in the oxidation-reduction potential or in the pH of fertilized and unfertilized sea urchin eggs. S. MORGULIS

The nitrogen excretion of gastropods. H. DELAUNAY. *Compt. rend. soc. biol.* 93, 626-8(1925).—The deproteinized ext. of the Bojanus organ of *Helix* contained 522 mg. N, of which 73% was purine N; uric acid N represented 26%, while urea N 11%, ammonia N 1.8% and the amino N 7.1% of the total. The blood contained 19 mg. non-protein N, 11 mg. urea N and 0.8 mg. purine N. S. MORGULIS

Influence of cholesterol and oxysterol upon the multiplication of infusoria (*Enchelys*). T. B. ROBERTSON. *Australian J. Exptl. Biol. Med. Sci.* 2, II, 83-90(1925).—Stable emulsions of cholesterol may be prepd. by discharging an alc. soln. of cholesterol slowly into distd. water which is continuously stirred. The alc. may be extd. with Et_2O , which does not ext. the emulsified cholesterol. The Et_2O may be removed by heating and aeration. Aeration of emulsions of pure cholesterol does not result in oxidation, but if traces of other acetone-sol. substances in brain tissue are present, aeration at boiling temp. rapidly oxidizes cholesterol emulsions with the production of a substance or substances resembling Lifschütz' oxysterol. Oxidation of cholesterol in this manner, or by benzoyl peroxide in glacial $AcOH$, di-

minishes, or even abolishes its power to accelerate the multiplication of infusoria (Euchelys). L. W. RIGGS

Conditions of activation of unfertilized star-fish eggs by the electric current. R. S. LILLIE AND WARE CATTELL. *Biol. Bull. Marine Biol. Lab.* 49, 100-10 (1925).—A new type of non-polarizable (Zn-ZnSO_4) electrode of low resistance is designed by which currents up to 2 amp. or more can be passed for long periods through a small quantity of sea water without appreciably affecting its compn. Unfertilized star-fish eggs can be readily activated by currents of 200 to 300 milliamp. per sq. cm., but the effect is due mainly to the heating action. With the temp. kept below 29° the current produces little or no effect. Eggs exposed in a stream of running sea water to a current of 600-800 milliamp. per sq. cm. for 30 to 120 sec. show marked deformation and a variable proportion shows fertilization membranes and partial activation. Similar tests with sea-urchin eggs gave negative results. L. W. RIGGS

Ionic reactions of the different constituents of the hen egg. Its modifications during the course of incubation. (Mlle.) FRANCE GUEYLARD AND P. PORTIER. *Compt. rend.* 180, 1962-3 (1925).—Before and during the first days of the development of the hen egg, the white shows a pH ranging from 7.25 to 8.69, and the yellow a range of 4.37 to 7.51. These figures for the white and yellow converge toward neutrality which is reached on about the 10th day of incubation. On the 17th day the yellow again becomes acid and also becomes viscous, retaining these properties to the end of incubation. A mixt. of the amniotic and allantoic fluids remains neutral or slightly acid. The embryonic tissues ground with water give a liquid slightly acid. The embryonic blood is more alk. than the blood of the bird after hatching. L. W. RIGGS

12—FOODS

W. D. BIGELOW AND A. E. STEVENSON

Temperature control in food factories. F. E. THOMAS. *Ind. Chemist* 1, 345-9 (1925).—T. describes the construction and operation of the Arca Regulator, a regulator in which the pressure on a diaphragm is exerted by water the flow of which is governed by the expansion and contraction of a metal tube. Application of the device to temp. control in the chocolate mfg. plant and in biscuit manuf. is dealt with. Seven illustrations. E. G. R. ARDAGH

Factory tests on food products. R. O. BROOKS. *Fruit Products J. and Am. Vinegar Ind.* 4, No. 12, 7-8 (1925).—Routine tests are cited, which can be made by a person who has had no training in analytical chemistry. J. A. KENNEDY

Rapid method for the determination of the ash of flour. J. TAUSZ AND H. RUMM. *Chem.-Ztg.* 49, 665-6 (1925).—Former attempts to shorten the time of ashing of flour involved the addn. of various substances, as H_2O_2 , alc., or NH_4NO_3 , or of their solns., to the coke residue. Usually it was the H_2O or the H_2O vapor which was effective. T.'s and R.'s method makes use of moist O_2 , and is more rapid than the others, requiring only $\frac{1}{2}$ hr. A piece of gold foil, holding about 1 g. flour in tablet form, is weighed and then placed in a Rose crucible. By use of a fireclay crucible oven, heated by a small flame, the flour is converted in 3 min. into a coke tablet. The crucible is then heated to about 800° and moist O_2 is passed in during the 15-20 min. required for ashing. The gold foil and ash, placed on a Cu block, can soon be weighed. M. W. MCP.

Bread cereals from physiological and economical standpoint. M. RUBNER. *Naturwissenschaften* 13, 645-51 (1925).—A review. B. J. C. VAN DER HOEVEN

The necessity for legislative control in the sale of milk breads. R. M. ALLEN. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* 2, 1315-7 (1923); *Expt. Sta. Record* 52, 505-6.—A tentative method for the detn. of the milk content of bread is given. This includes the detn. of lactose and of fat. For the former, 50-60 g. of fresh or air-dried bread are digested in distd. water at about 40° for 1 hr., and the ext. is sepd. by adding 20 g. of Filter-Cel, centrifuging twice, and finally filtering through a Buchner funnel contg. Filter-Cel. To the ext. are added 35 g. of starch-free yeast and, after warming to 80° F., 0.5 g. of $(\text{NH}_4)_2\text{SO}_4$. The mixt. is aerated by means of compressed air for at least 2 hrs., made up to 1000 cc. and filtered, and the filtrate used for the detn. of lactose by the gravimetric Cu reduction method. For the detn. of fat, 200-300 g. of finely ground air-dried bread is digested by boiling for about 1 hr. with 1000 cc. of distd. water and 30 cc. of HCl . The mash is then filtered through a Buchner funnel after the addn. of 10 g. of Filter-Cel. The residue is stirred with ether and filtered through Filter-Cel into a dry flask. After evap. the ether the oil is used for detg. the R.-M. no.

Flavor as an aid to assimilation. R. B. HAWK. *Am. Food J.* **20**, 426-7(1925).—Our foods must be rated not according to flavor or taste, but upon the basis of actual food value. J. A. KENNEDY

Manufacture of pectin. C. P. WILSON. *Ind. Eng. Chem.* **17**, 1065-7(1925).—A review of patent and other literature bearing on the manuf. of pectin prefaces the discussion of the principles utilized in the recovery of this substance. Raw materials are apple, citrus and beet refuse pulp or carrots. The production of pectin is followed through the several stages in its development, from the use of apple pectin stock to assist in jelling the juice of other fruits to the production of a dry pure pectin from citrus fruits by the application of principles of colloid chemistry. L. W. RIGGS

The commercial manufacture of pectin sirups and powdered pectins. W. ROOKER. *Fruit Products J. and Am. Vinegar Ind.* **5**, No. 1, 10-11, 18(1925).—In article, the first of a series, R. discusses the source of pectin. J. A. KENNEDY

Water-soluble solids content of fruit preserves and jams. C. P. LATHROP and W. LOWE WALDE. *Fruit Products J. and Am. Vinegar Ind.* **5**, No. 1, 5-6(1925).—Using the Abbé refractometer the authors have examd. 180 samples of preserves and jams from 26 producers representing nearly all the producing sections of the U. S. These preserves fall into two groups. The water-sol. standard of 68% is found to be too high for group II, 66% being nearer. J. A. KENNEDY

The development of dehydration [of fruit] in California. A. W. CHRISTIE. *Am. Food J.* **20**, 474-5(1925). J. A. KENNEDY

The chemistry of milk. LUCIEN LEROUX. *Rev. gén. sci.* **36**, 178-80(1925).—Brief review of the work published during the last 4 yrs., with bibliography of 48 references. A. PAPINEAU-COUTURE

The germicidal action of milk. J. M. SHERMAN AND H. R. CURRAN. *Proc. Soc. Exptl. Biol. Med.* **22**, 15-17(1924).—A rapidly growing 3-hr. culture of *Streptococcus lactis* in milk was transplanted to fresh sterile milk. Controls of autoclaved milk showed continuous active growth. A lag period of $\frac{1}{2}$ hr. followed by active growth occurred in fresh milk. C. V. B

The Rupp method for the detection of chlorine in milk. J. T. KEISTER. *Am. J. Public Health* **15**, 781-4(1925); cf. *C. A.* **17**, 315.—Not only is I liberated from KI by free Cl and compds. resulting from the action of Cl on various milk constituents, but Cu salts will produce the same result. Milk naturally contains a little Cu; processed milk contains more. Whenever it is found that the Rupp test is positive a detn. for Cu should be made. More than 1 part in 425,000 parts of milk is sufficient to give the test. FRANK E. RICE

A new method for the determination of the water content of milk powder and the properties of its colloidal constituents. E. A. HAUSER. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* **2**, 1154-7(1923); *Expt. Sta. Record* **52**, 505.—The method is based upon the temp. change taking place when a given amt. of the milk powder is dissolved in a given amt. of water. With powder of 0-3.5% moisture, the addn. of water causes a rise in temp. due to the heat of swelling and the heat of hydration of lactose. At a higher moisture content there is also a negative heat reaction due to the soln. of the mineral salts. The resulting temp. change under these conditions is the difference between the heat of swelling (positive) and the heat of soln. (negative). Curves have been worked out for the temp. rise in standard milk powder with different amts. of water. H. G.

Freezing point of colostrum milk, normal milk and end milk of lactation; and its practical value for detection of water added. M. SATO. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* **2**, 1173-4(1923); *Expt. Sta. Record* **52**, 505.—The min., max. and av. values for the f. p. of a large no. of samples of colostric, normal and end-of-lactation milk from cows of different breeds are: colostric milk $\Delta = -0.5, -0.64, -0.567$; end milk $\Delta = -0.53, -0.57$ and -0.552 . The ranges for normal individual and mixed milk were $\Delta = -0.51$ to -0.59 and -0.53 to -0.58 , with a general av. of -0.548 . S. considers that the f. p. method can be used with some degree of certainty for detecting the addn. of 5% of water and accurately for 10%. H. G.

Effect of various oil cakes on the fat content of milk. N. LANZILLOTTI. *Industria lattiera e casearia* **22**, 85-7, 100-1, 116(1924); *Rev. internat. renseign. agr.* **3**, 257-60(1925).—Tests with 9 cows, over a period of 58 days with linseed, sesame and corn cakes showed the linseed and sesame are not as well liked by the cattle as corn and can cause serious trouble if given in too large quantities; none of the cakes had appreciable effect on the wt. of the animals; they all had a favorable effect on milk secretion; linseed caused the greatest, and corn the smallest increase in fat content. A. P.-C.

Preservation of milk samples for examination. W. STURM. *Chem. Weekblad* **21**,

606-7(1924).—Addn. of 0.8 cc. of formalin per l. of milk enables samples to be kept for a week without practical change in the acidity or f. p. A correction is applied to the latter, detd. by taking the f. p. before and after addn. of the preservative. B. C. A.

The keeping quality of dry milk. G. C. SUPPLEE. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* 2, 1248-53(1923); *Expt. Sta. Record* 52, 505.—The types of deterioration discussed are staleness, rancidity and tallowiness. Staleness, which is accompanied by decreased soly. and darkening in color, is most likely to occur in skim milk powder and is considered to be due to excessive moisture content. Rancidity and tallowiness, types of deterioration occurring in whole milk powders, are attributed to changes occurring in the fat from enzyme action and oxidation, resp. H. G.

The principal factors affecting the keeping quality of sweetened condensed milk. A. MIYAWAKI. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* 2, 1233-40 (1923); *Expt. Sta. Record* 52, 504.—M. believes deterioration of condensed milk may be due either to bacterial or phys. changes on aging. The most common and troublesome form of deterioration is thickening, which may be caused either by aging, in which case it is corrected by stirring, or by bacterial action, in which case the change is irreversible. To avoid thickening, the following precautions are recommended: the milk to be used should contain more than 3% butterfat, the amt. of sugar to be added should be more than 15% of the whole milk by weight, the vacuum should be maintained at higher than 26 in., and the condensing should be finished in less than 25 min. per 1000 lb. of fresh milk. H. G.

The crystals found in sweetened condensed milk. M. SATO. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* 2, 1285(1923); *Expt. Sta. Record* 52, 503.—The microscopic examn. of crystals from samples of com. sweetened condensed milk showed 2 types of crystals, "one taking a bushlike form of needles and their masses, and the other taking a trapezoidal form. The former on analysis was found to be mostly tricalcium citrate and sometimes the crystals of tyrosine were found therewith. $\text{Ca}_3(\text{PO}_4)_2$ and $\text{Mg}_3(\text{PO}_4)_2$ were also present in an amorphous condition, and the crystals of leucine and cystine were also observed. The crystal in a trapezoidal form was found to be the same as that of milk sugar in its chem. nature. H. G.

Sediments of evaporated milk. M. SATO. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* 2, 1284, 1285(1923); *Expt. Sta. Record* 52, 504.—Crystals in the bottom of a can of evapd. milk which had been kept for over 2 years were found on analysis to be composed of $\text{Ca}_3(\text{PO}_4)_2$, $\text{Mg}_3(\text{PO}_4)_2$ and $\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2$. H. G.

Starters. I. Influence on starters of air supply, temperature of incubation and rate of ripening. P. TOENS AND B. W. HAMMER. *Iowa Agr. Expt. Sta., Res. Bull.* 85, 163-72(1925).—The air supply influences the flavor and aromatic development in a starter and the rate of acid development which is more rapid with a restricted air supply. Good starters develop over a wide temp. ranging from 18° to 32°. **II. Acetone in distillates from starters and from milk.** F. F. SHERWOOD AND B. W. HAMMER. *Ibid.* 173 9.—Acetone was found in mixed milk and in starters. The acetone content of starters was comparable to that of the milk from which the starters were prepd. and is attributed to the acetone present in milk. J. J. SKINNER

Acidophilus milk: a therapeutic agent and health drink. L. F. RETTGER. *Am. Food J.* 20, 301-2(1925). J. A. KENNEDY

The microflora of the mammary gland from the standpoint of the dairy industry. COSTANTINO GERINI. *Rev. internat. renseign. agr.* 3, 64-89(1925).—A review with bibliography of 81 references, covering its compn., origin, pathogenic characteristics, anomalies, relation to the cheese industry under normal and abnormal conditions, and milk control from the standpoint of the microflora. A. PAPINEAU-COUTURE

Control experiments on cheese in Denmark. CHR. H. IBSEN. *Beretning fra Forsøjskoles Laboratorium for Landøkonomiske Forsøg* No. 115, 1-25(1924); A. C. ANDERSEN AND J. E. WINTHER. *Ibid.* 26-66; *Rev. internat. renseign. agr.* 3, 627-32 (1925).—From the results of a large no. of expts. carried out in 44 cheese factories a table has been drawn up indicating the % fat required in the milk to be curdled, for various fat contents of the whole-milk used, in making cheese contg. 45, 30, 20 and 10%, resp., of fat on the dry basis. H_2O in cheese was detd. by drying on pumice at 98-100°. The Schmid-Bondzinsky-Kadzlaiff (S. B. R.) method of fat detn. is too slow and expensive when a large no. of analyses must be carried out. Carefully carried out duplicate detns. of fat and H_2O should agree within 0.15% in 95% of the analyses (variations are about twice as large in fat detns. on Roquefort type cheeses). With hard cheeses the variations in duplicate on the same sample are $\pm 0.1\%$ in 67% of the analyses, ± 0.2 in 95%, and ± 0.3 in 99.7%, while with Roquefort type the variations are ± 0.2 , ± 0.4 , ± 0.7 , resp. Variations in duplicate detns. made on different samples

are twice as large as those on the same sample. The van Gulik modification of the Gerber method is preferable to the Cooper modification as a rapid method. The van Gulik method gives results agreeing very well with the S. B. R. method for 30-40% fat contents, but higher results with cheeses having very high fat contents, and lower results with skim-milk cheeses. Duplicate detns. on the same sample by the van Gulik method differ by more than $\pm 0.2\%$ in about 5% of the analyses; but the method is liable to give errors 4 times as large as the S. B. R. method. With samples from cheese which is exceptionally heterogeneous, the errors may be greater than indicated above.

A. PAPINEAU-COUTURE

The presence of amylase in milk and cheese. M. SATO. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* 2, 1174, 1175(1923); *Expt. Sta. Record* 52, 506. reports the presence of amylase in samples of grade A certified milk and in American Cheddar cheese. A comparison of the rate of digestion of various starches by amylase showed sol. potato starch to be digested more easily than rice starch and in turn more easily than ordinary potato starch.

A study of soft-cheese making. M. E. LIMUACO. *Philippine Agr.* 14, 143-54 (1925).—The butterfat and casein contents of native soft cheeses ranged between 11.25-29.10 and 8.45-60.31%, resp. Detns. of moisture, ash, reducing sugar, NaCl and acidity are presented for a variety of cheeses.

A. I. MEHRING

A bacteriological study of soda water. LEROY FOREMAN. *Public Health News (N. J.)* 10, 228-30(1925).—Duplicate samples were collected. One bottle was tested at once for bacterial count and *B. coli*; the second one week later. The first batch showed such good results that some bactericidal ingredient was sought. Succeeding samples after planting were seeded with a 24-hr. culture of *B. coli*. Of inoculated samples 75% failed to show an increase. Blanks with water showed about 500,000 organisms. Acidity as citric acid, solids from immersion reading, dyes used for coloring, and artificial ethers showed no relation to bacterial condition. Total CO_2 was detd. Conclusions: No single constituent is responsible for the condition shown but the CO_2 content is the most potent single factor.

JACK J. HINMAN, JR.

Fat in commercial casein. H. JEPHCOTT AND N. RATCLIFFE. *U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.* 2, 1271-6(1923); *Expt. Sta. Record* 52, 506.—A discussion of the factors influencing the fat content of com. casein and the most suitable methods of detg. fat in casein. Fat detn. on sepd. milk and the whey, wash water and rennet casein obtained from the milk showed the fat content of the casein to depend almost entirely upon that of the sepd. milk. Firmness of the curd appeared to affect somewhat the readiness with which the fat was retained by the casein. A comparison of the Soxhlet, Roese-Gottlieb, Gangolli-Meldrum and Werner-Schmidt methods of detg. fat in rennet and acid casein showed the Werner-Schmidt method to be the most satisfactory. The Soxhlet method extd. only a small % of the total fat. Both the other methods gave good results with finely divided acid casein, but failed entirely with rennet casein. With the Werner-Schmidt method consistent results were obtained on all cases.

H. G.

Bacterial content of head lettuce. L. B. JAMES. *Am. Food J.* 20, 302-4, 310 (1925).—The total no. of bacteria showed a decrease with increasing depth into the head. Storage at room temp. resulted in an increase in bacteria on the outer leaves from 10,000,000 to 1,000,000,000 and on the inner leaves from about 300,000 to nearly 2,000,000,000 organisms per g. within 4 days. At the end of the time the lettuce was badly rotted throughout. Lettuce stored at 21° under controlled humidity underwent decompn. much more slowly and carried much smaller bacterial no., remaining in fairly good condition for 6 days. The acidity of lettuce averaged from p_H 5.4 to 4.8. A decomposed portion of a rotting leaf gave a p_H of about 7.0 while adjoining it, yet still firm and green portions, gave p_H 5.4. Lettuce stored without washing allowed less bacterial development and maintained a better phys. appearance than that which was first washed.

J. A. KENNEDY

The significance of the occurrence of copper, manganese and zinc in forage crops and foods. J. S. MCHARGUE. *J. Am. Soc. Agron.* 17, 368-72(1925).—Fertile soils contain small quantities of Cu, Mn and Zn. Plants absorb small quantities of these elements, which are stored in the leaves, pericarps and germs of the seeds. When corn, wheat and rice are highly milled the resulting degermed cornmeal, patent flour and polished rice are deprived of the greater part of the compds. of Cu, Fe, Mn and Zn, which appear to be factors in animal nutrition. Some depleted soils may require the addn. of Cu, Mn and Zn in order to restore and maintain productivity and to produce a food supply contg. the vital factors in normal proportion.

F. M. SCHERTZ

Composition and digestibility of lupins. GES. FÜR LUPINENINDUSTRIE. *Landw.*

Vers. Sta. 103, 209-12(1924); F. HONCAMP. *Ibid* 213-20.—The methods used for the removal of the bitter substances from lupins and other points in the work of Honcamp and his colleagues are criticized and the criticism is replied to. B. C. A.

Wyoming forage plants and their chemical composition (CUNDR) 11D. Medicinal products from yeast and methylene blue, etc. (Brit. pat. 230,404) 17.

BAILLEY, C. H.: *The Chemistry of Wheat Flour*. Am. Chem. Soc. Monograph. New York: The Chemical Catalog Co. 314 pp. \$4.00. Reviewed in *Ind. Eng. Chem.* 17, 1097(1925).

CRUESS, WILLIAM V.: *Home and Farm Food Preservation*. Revised Ed. New York: The Macmillan Co. \$2.50. Reviewed in *Am Food J.* 20, 311(1925).

Nutrient composition rich in vitamins. H. LIEBERS. U. S. 1,552,176, Sept. 1. A food having a fruit-like aroma is prepd. from yeast and an ext. from germinated cereals of such concn. as to prevent fermentation when the ingredients stand together.

Control devices for pasteurizing apparatus. F. J. BAST. Brit. 230,090, March 1, 1924.

Apparatus for dehydrating vegetables, fish or meat. M. E. BUSSLER. U. S. 1,552,210, Sept. 1.

Apparatus for treating wheat or other grain with fumigating gases. L. RIETCHECK. U. S. 1,552,233, Sept. 1. Exhaust gases from internal combustion engines may be used.

13—GENERAL INDUSTRIAL CHEMISTRY

HARLAN S. MINER

General considerations on the evolution and present status of the chemical industry. P. FLEURENT. *Bull. soc. ind. Rouen* 53, 223-54(1925).—An address. A. PAPINEAU-COUTURE

The teaching of applied chemistry and the placing of the chemical engineer. ALBERT RANC. *La nature* 53, ii, 44-6(1925).—A discussion with special reference to the status of the chem. engineer in various countries. C. C. DAVIS

Study of industrial chemistry by the unit plant research development method. F. C. VILBRANDT. *J. Chem. Education* 2, 748-52(1925). E. J. C.

Badische Anilin- und Sodafabrik, 1865-1925. A. E. *Technik u. Ind. u. Schweiz. Chem.-Ztg.* 1925, 149-60(1925). E. J. C.

How are gases dried? W. PAULSEN. *Apparatebau* 37, 234-5(1925).—Drying with H_2SO_4 and by cooling is briefly discussed. J. H. MOORE

The absorption of gases and vapors by liquids. J. BROWN. *J. Soc. Chem. Ind.* 44, 410-121(1925).—"The fundamental principle governing the process of gas-washing for the recovery, or removal, of some component of a gas or vapor is that the solvent can absorb the gas or vapor until the vapor pressure of the latter in soln. is equal to the partial pressure of the gas or vapor in the gases entering the washing unit." A fundamental equation is deduced for expressing the laws governing the absorption or soln. of gases in liquids. Certain data relative to plant efficiency can be gathered from the deduced formulas, for which reference must be made to the original paper. W. H. B.

Insulation of hot surfaces and furnace walls. L. B. McMILLAN. *Iron Steel Eng.* 2, 301-10(1925).—McM. discusses losses from bare heated surfaces, the effect of air velocity on surface losses, from insulated surfaces, and through furnace walls. Also, the economical thickness of insulation, and application to hot-blast stoves, mains and bustle pipes, heating furnaces, by-product coke ovens and regenerators. Insulation saves valuable heat, improves working conditions near the heated equipment and results in increased production. Discussion brought out that different kinds of paints have different insulating values and insulation should be outside the shell. Limitations as applied to blast furnaces and open-hearth furnaces and soaking pits in connection with refractories now available are pointed out. W. H. BOYNTON

American Society for Testing Materials. Standards adopted in 1925. *Separate* 117 pp.(1925).—Standard specifications are given for Cu trolley wire; seamless 70-80 brass and seamless Muntz metal condenser tubes and ferrule stock; quicklime and hydrated lime for rag cooking in paper manuf.; gypsum; gypsum plastering sand, wall board, plaster board and partition tile or block; asphalt for damp-proofing and water-

proofing below and above ground level; primer for use with asphalt in damp-proofing and waterproofing below and above ground level; high-C coal-tar pitch, high-bitumen coal-tar pitch and bituminous grout for a like purpose; creosote oil for priming coat with coal-tar pitch in damp-proofing and waterproofing; asphalt mastic and woven cotton fabrics and burlap satd. with bituminous substances for use in waterproofing; imperfections and tolerances for square-woven and for cord tire fabrics, tolerances for hose ducks and belt ducks; tolerances and test methods for elec. cotton yarns; Osnaiburg cement sacks; and for A. S. T. M. partial immersion thermometers for general use. Standard methods are given for: compression tests on concrete, testing oleo-resinous varnishes; detn. of wax in shellac; analysis of Ti pigments; vol. correction table for petroleum oils; test for apparent sp. gr. of sand; stone and slag screenings and other fine non-bituminous highway materials; test for penetration of bituminous materials; sampling bituminous materials.

Safety first in storing chemicals. H. F. DAVISON. *J. Chem. Education* **2**, 782-3 (1925). E. J. C.

An effective method for conducting experiments on dust inhalation (DRINKER)

14. Manufacture and repair of electric accumulators [Pb poisoning] (PRICE, BRIDGE)

Recovering gases from liquids permitted to fall onto a hot surface. H. FOTHERGILL. *Brit.* **230**, 160, Dec. 1, 1923. *Mech. features.*

14—WATER, SEWAGE AND SANITATION

EDWARD BARTOW

Purification of water. F. DIENERT. *Compt. rend.* **180**, 1228-9 (1925); *Bull. mens. office intern. hyg. publ.* **17**, 684 (1925). —There is a spontaneous underground purification of water by chem. processes in which ferrous and manganous salts take part. It includes the disappearance of dissolved O and nitrates. Such water may also contain H_2S and may be almost or quite sterile. A test may be made by taking 500 cc. of water and 10 g. each FeS and chalk. After 8 days' contact it is sterile. One condition is that the water be of low org. content. Biol. purification requires ripening of filters. Submerged filters require a coating of algae, diatoms and bacteria. Non-submerged filters require 60 days to get into shape to remove *B. coli*, 8 days to nitrify NH_3 and 9 days to destroy phenol, according to observations. Such a prepared filter may purify water contg. 1 or 2 p. p. m. phenol, an important matter in connection with chlorination.

Sterilization of water by ultra-violet rays. F. DIENERT. *Ann. hyg. publ. ind. et sociale* **1924**, No. 10, 586; *Bull. mens. office intern. hyg. publ.* **17**, 321 (1925). —Henderson, Ky., and Wyandotte, Mich., are reported as Am. installations. Installations in France are noted at Maromme, near Rouen and at Ille-sur Sorgues. Monaco also has a plant. The current consumption is 25 to 30 w. per cu. m. It will be necessary to construct a lamp of the following characteristics before the process will be satisfactory in every way: (1) Automatic lighting without tilting, (2) max. power developed as soon as lighted; (3) const. and uniform activity of ultra-violet rays, (4) non-metallizing of the lamp; (5) same intensity of ultra-violet light during entire time of functioning; (6) least possible current consumption; (7) operation at high voltage; (8) low price. A bibliography is appended.

Sterilization of water by liquid chlorine. J. M. MATHIEW. *Commonwealth Eng.* **13**, 30-3 (1925). —The water supply of Victoria Australia is chlorinated with a W. & T. machine; dosage about 0.4 p. p. m. at a cost of 5d per million gals. B. H. P.

Notes on the chlorination of the Manila water supply. EDWARD TAYLOR. *Philippine J. Sci.* **27**, 297-313 (1925). —During the dry season of 1912 the water supply was first chlorinated by means of $CaOCl_2$. Treatment was resumed in 1914 with 0.5 to 0.75 p. p. m., this effected a bacterial reduction of 50% to 65%. An invariable dose of 0.6 p. p. m. was then adopted. The varying chlorine-consuming capacity made such treatment unsatisfactory and in 1923 a variable dosage was adopted by which the residual Cl is kept at 0.05 to 0.1 over the distribution system. No definite relation is found between the turbidity and the Cl-consuming capacity. Tables are given of the operating data for 1923-24.

Control of the chlorine apparatus of the indoor swimming pool of Frankfurt. AL.

GERSBACH. *Gesundh. Ing.* 47, 57(1924); *Bull. mens. office intern. hyg. publ.* 17, 89-90 (1925).—A pool of 750 cu. m. capacity has its water recirculated in 12 hrs. Filters and chlorination to the extent of 0.3 p. p. m. Cl are used. After 10 months' recirculation the water was as satisfactory as that of a women's pool which was filled weekly but not disinfected. Water is changed more frequently on account of algae which grow in joints of tile flooring although the pool is cleaned mechanically daily. J. J. H., JR.

Fifty-eighth Annual Report of the Commissioners of Water Works in the City of Erie, Pa., for the year ending Dec. 31, 1924. 68 pp.—The daily av. per capita consumption was 188 gallons, and the cost of collecting, purifying and pumping the water was \$21 927 per million gallons. The no. of gallons of water pumped per lb. of coal used was 255.6. The yearly av. amt. of alum applied was 0.196 grains per gallon, and of hypochlorite 0.36 p. p. m. No positive results were obtained in 616 samples of filtered water examd for *B. coli*. Extensions to plant included 4 additional filter beds of 2 million gallons per day capacity each, at cost of \$113,976. R. E. THOMPSON

Features of Newark, Ohio, water-softening plant. C. T. KAISER. *Eng. News-Rec.* 95, 474-5(1925).—Water treatment at Newark consists of softening, filtration through mesh filters, and finally carbonation with scrubbed and dried boiler gases. Settling basins are equipped with Derr clarifiers for continuous sludge removal. Split chem. treatment is employed as the water is high in Mg. R. E. THOMPSON

Reinforcing the water supply of Horton, Kansas. N. T. VEATCH. *Eng. News-Rec.* 94, 931-2(1925).—Recent improvements to the Horton water supply system include an earth-fill dam on Mission Creek, intake and pipeline to existing purification plant consisting of a coagulation basin and filters constructed in 1910. Ultra-violet-ray treatment is employed for sterilization. R. E. THOMPSON

From filters to small wells, then to large wells. W. A. CONE. *Eng. News-Rec.* 95, 216-7(1925).—Water works improvements at Montgomery, Ala., are described. R. E. THOMPSON

Wood-grating in filters and cemented-gravel layer—symposium. *Eng. News-Rec.* 94, 1062-5(1925).—J. W. Ellms corroborates some doubts raised by Milwaukee expts. Wellington Donaldson states that metal distributors are more dependable than gravel. Baltimore experience with slat-bottom type is satisfactory according to J. W. Armstrong. J. W. Kelsey discusses iron ridge block diffusers and wood grating used at St. Paul. Wm. Gore reports that cemented-gravel slabs are satisfactory at Toronto and elsewhere. R. E. THOMPSON

The action of sulfates in drinking water. J. H. VOGEL. *Kali* 19, 293-6(1925).—The conclusion is reached that the concn. of 0.25 g./l. of $MgSO_4 + Na_2SO_4$ which, because of chem. works effluents, may be reached in the Bremen water supply is entirely harmless even to bottle-fed babies. WM. B. PLUMMER

The aging of natural mineral waters. OSKAR BAUDISCH and L. A. WELO. *J. Biol. Chem.* 64, 771-9(1925).—The water from the Glaubergquelle at Franzensbad is perfectly clear but on standing, even when retaining its CO_2 content, a yellowish white ppt. appears. The change is accelerated by light. It is suggested that the loss of the therapeutic properties of mineral waters on standing may be due to changes in the configuration of the active mol. In the case of the Glaubergquelle water, this may be an inactivation of the $Fe(HCO_3)_2$ the water is known to contain. I. GRÜNENWALD

Fallacy of the test for lactose fermenters as an indicator of fecal pollution of waters. OTTO SCHÖBL and JOSÉ RAMÍREZ. *Philippine J. Sci.* 27, 317-24(1925).—The occurrence of fermenting bacteria in Manila wells was found due to contamination of pump parts. The examn. of specimens from animals, birds, fishes and insects showed lactose fermenters other than *B. coli*. Examn. of samples from plants showed lactose fermenters. The authors conclude that lactose fermentation is not an indication of fecal pollution. Tests failed to differentiate between *B. coli* of human and animal origin. BEN H. PETERSON

• **Pollution and natural purification of the Ohio River. II. Report on surveys and laboratory studies.** W. H. FROST and H. W. STREETER. U. S. Pub. Health Service, *Bull.* 143, 343 pp.—The river is polluted by domestic and industrial sewage, surface water and acid mine drainage. In general, the turbidity of the river tends to increase as the water passes downstream and reaches its max., approx. 200 p. p. m., at or below Cincinnati. The total N, org. and ammoniacal N, and oxidized N contents vary within a range too narrow to afford precise measurement of the effect of sewage pollution, and the O-consumed values provide even a less sensitive index. Bacteriological examn. of samples included gelatin and agar counts and quant. tests for *B. coli*. The ratio of 20° gelatin to 37° agar counts varied from month to month and as a general rule was greater during the winter and spring. The ratio of gelatin counts to *B. coli* showed a

similar seasonal variation. These changes in ratio appear to be more closely related to season and temp. than to hydrographic conditions. Studies of the actual nos. of bacteria added in city wastes confirmed the previous observations of Phelps that there is a regular cyclic seasonal variation in the total bacterial content of wastes. The summer av. was more than 10 times the winter av. for the agar count group and 5 times the winter av. for the gelatin and *B. coli* groups. It seems probable that temp. is the controlling factor in this bacterial cycle. A disproportionately small effect of the sewage from the Pittsburgh and Wheeling district upon the bacterial content of the Upper Ohio river was also noted. This is probably due to the inhibitory effect of acid Fe salts, derived from the drainage of coal mines and the wastes from steel industries, present in the river water in this district, and to the aptn. effected by the intermingling of these waters with alk waters from other sources. bacteriological studies relating to the extent and rates of natural purification. A gradual increase in the bacterial content of the river water on passing down stream from a sewer outfall was observed. Conclusive evidence is not forthcoming, however, as to whether this increase is due to actual multiplication of bacteria cells or more complete dispersion of cells originally clumped together, or, in view of the imperfect mixing of the sewage with the river water at the outset, to errors in sampling. During the summer this initial increase attained a max. at about 10 hrs. for *B. coli*, 12.5 hrs. for agar counts, and 15 hrs. for gelatin counts. Beyond this observed max. the nos. of bacteria decreased at a progressively diminishing rate, being after 183 hrs. less than 1% and after 245 hrs. less than 0.1% of the max. The rate of decrease was highest in the *B. coli* group, next in the agar count group, and least in the gelatin group. Observations were not so precise for winter conditions, there were, however, definite indications that a similar or nearly decrease in bacteria occurred but at less rapid rates. B. C. E.

The hydrogen-ion concentration of certain Wisconsin lake waters. C. JUDAY, E. B. FRED AND F. C. WILSON. *Trans. Am. Micr. Soc., Menasha* 43, 177-90(1924); *Abstracts Bact.* 9, 72.—“Changes of the H-ion concn. of Lake Mendota are correlated with the seasons. During the spring and autumn periods of circulation, the H-ion concn. is substantially uniform for all depths. During the summer and winter periods of stratification, the upper water is much more alk. than the lower. The photosynthetic activities of the algae cause an increase in the alk. of the upper water. CO₂ (liberated chiefly by decomposing org. matter) causes a decrease in the alk. of the lower water. In 5 lakes besides Mendota the upper water was more alk. than the lower in summer.” H. G.

New formula for flow of water in clean cast-iron pipe. EDWARD WEGMANN AND A. N. AERYNS. *Eng. News-Rec.* 95, 100-2(1925).—A formula is given which agrees more closely with expts. than any other. R. E. THOMPSON

Recent sewage treatment developments in America. KARL IMHOFF. *Eng. News-Rec.* 95, 180-1(1925).—Observations are made on screens, tanks, sludge digestion, trickling filters and activated sludge treatment. R. E. THOMPSON

Activated sludge process: aeration and circulation. W. T. LOCKETT. *Surveyor* 66, 525-9(1924); 67, 9-10(1925).—Expts. with strong and average sewage indicated that the vol. of air necessary for adequate mixing and circulation usually gave most rapid purification and was most economical. Diffused air is about 3 times as effective as air applied in large bubbles. Intermittent aeration saves 10% of air required to purify av. sewage and 25% for strong sewage, although time for purification is increased in both cases. The dissolved-O test best shows the condition of the sludge and working capacity of diffused air plant. After the relation of dissolved O in the aeration tank to dissolved O in the final effluent is detd., analysis of the latter is sufficient for control work. At Withington dissolved O in the effluent is detd. every 3-6 hrs.; 2 p. p. m. dissolved O in the final effluent insures optimum aeration period. Data and analytical results on demonstration and spiral flow plant at Withington are given. B. C. A.

Disposal of excess activated sludge by digestion. KARL IMHOFF. *Eng. News-Rec.* 94, 926-7(1925).—Data derived from expts. in the Ruhr District are given. Conditions necessary for rapid and odorless decompn. of sludge are (1) time (capacity), (2) warmth, and (3) inoculation and mixing. Condition (1) depends on (2) and (3). Decompn. increases directly with temp. and is best effected in 2-story tanks. A mixt. of 0.5 part fresh sewage sludge, 0.5 part activated sludge and 1 part digested sludge digests most rapidly and produces the greatest quantity of gas. The compn. of the gas from activated sludge is the same as that from sewage sludge if both are inoculated with digested sludge, and the total gas amounts to 16 l. (4 g.) per capita daily, the power contained being probably sufficient for operation of the aeration tanks. Digestion of the excess activated sludge increases the total amt. of digested sludge from 0.2 to 0.36 l. per capita per day,

but the quantity of activated sludge is reduced from 2.5 to 0.16 l. per capita. The time required for digestion is 3 months and the digestion tank capacity required for digestion of both sludges is approx. 50 l. per capita. The data for large plants might be more favorable.

Activated sludges. F. DIENERT. *Compt. rend.* **181**, 159–61(1925); cf. C. A. **15**, 3710.—An activated sludge is not necessarily able to oxidize rapidly S or polythionates. It ought to become able gradually, and this ability may be hindered by the presence of certain substances such as $\text{Ca}(\text{AcO})_2$. With active MnO_2 the presence of $\text{Ca}(\text{AcO})_2$ arrests the oxidation at the hyposulfite instead of the sulfate stage. L. W. RIGGS

Activated sludge from the colloidal standpoint. F. DIENERT. *Rev. gen. colloides* **3**, 193–9(1925).—Both org. and inorg. activated sludges owe their activity to their oxidizing power, which is due to the microbes which they contain. All activated sludges are electronegative. Unactivated MnO_2 , which is also electronegative, possesses a special adsorbing power, which apparently does not exist in org. activated sludge because the latter does not immediately clarify turbid sewer water as does the MnO_2 . This example shows that an electronegative powder can adsorb a colloid of the same sign. The agglutinating power of activated sludges seems to depend entirely on their oxidizing power and becomes max. when the sludge can oxidize NH_3 . Oxidation decreases the viscosity of the liquid and causes superficial change in, and agglutination of, the colloidal matter. The activity of the sludge increases with the degree of aeration and decreases with the degree of septic action to which it has been subjected. The rate of dehydration of activated sludge is max. for a p_H of 3.0. A. PAPINEAU-COUTURE

Ratio of loss on ignition to oxygen consumed for industrial wastes and sewage. M. S. NICHOLS. *Am. J. Pub. Health* **14**, 693–5(1924).—The ratio of loss on ignition to O consumed averaged 2.25:1 for vegetable wastes and 4.86:1 for domestic sewage. Non-org. waste from a steel-tube factory gave a ratio of 12:1. Loss on ignition was detd. at dull red heat, and O consumed by oxidation with KMnO_4 in acid soln. at or near the b. p. for 30 mins. B. C. A.

Disposal of liquid trade wastes. J. H. GARNER. *J. Soc. Dyers Colourists* **41**, 299–302(1925).—The conditions of disposal of waste liquids are considered: (a) when the liquids are discharged into streams, and (b) when the liquids are discharged into sewers. The regulation of flow, treatment of liquid wastes before discharge and some of the legal questions involved are discussed. L. W. RIGGS

Sewage works extensions, Macclesfield. F. T. HAMBLETON. *Munic. Eng.* **75**, 586–7(1925).—Recent improvements to sewage works included installation of new percolating filters and the construction of a "simplex" activated-sludge plant in 2 disused Dortmund tanks, with the original sludge tank as a settling tank. The activated-sludge plant will be employed for treatment of tank effluent and will be operated only during the hours of greatest flow and max. strength. R. E. THOMPSON

Small sewage pumping station at Eveleth, Minn. H. A. ROBINSON. *Eng. News-Rec.* **95**, 227(1925).—Pumping and screening station, by means of which sewage formerly discharged through septic tanks into Fayal Pond will be diverted to the main sewage works. R. E. THOMPSON

Accident to Imhoff tank units at Fort Worth, Texas. J. B. HAWLEY. *Eng. News-Rec.* **95**, 54–5(1925).—Damage to partition walls of Imhoff tanks at Fort Worth by an explosion (or possibly water hammer) is described and illustrated. R. E. T.

The utilization of city sewage. HEINRICH MÜLLER. *Tech.-Ind. u. Schweiz. Chem.-Ztg.* **1925**, 123–4.—The sewage of a city like Berlin carries between 400,000 and 500,000 gold marks value of fertilizer. Experience at Munich shows a yearly production of 3200 tons N_2 , 800 tons P_2O_5 and 750 tons lime in about 107 million cu. m. sewage. This can be utilized after a preliminary purification as fertilizer. In Munich it is utilized in fish ponds. Large cities may run the partially settled sewage over tracts of ground and use the deposits as fertilizer. The high price of fertilizers makes this recovery imperative. BEN H. PETERSON

Goiter and drinking water. J. A. GOODFELLOW. *Munic. Eng.* **75**, 526–7(1925).—A general discussion of I deficiency theory of goiter and of iodization of water. The water supplies of Ilkeston and Heanor are being treated with NaI as at Rochester, except that the salt is applied continuously. At Ilkeston, where the consumption averages 1,600,000 gal. per day, 2 lb. NaI is added per week. R. E. T.

The inverse relation of iodine and goiter, in Utah. J. C. HATHAWAY. *Proc. Soc. Exptl. Biol. Med.* **22**, 183(1924).—Towns having I_2 in their drinking water in parts per million of 216, 250, 61 and 18 had a goiter incident in % of 6, 15, 45 and 57, resp. C. V. B.

The deodorizing of tunnels of the Metropolitan by ozone. JACQUES BOYER *La*

nature 53, ii, 97-9(1925).—An illustrated description. The use of ozonizers in the Paris underground railways has successfully deodorized and purified the air to a remarkable degree. The app. is of new design and includes an O_3 generator which operates with an a. c. at 5000 v. by reduction of the d. c. traction voltage of 550 v. to 110 v. and conversion of the latter to a. c. at 5000 v. The complete system also includes a ventilating and filtration system for the air. C. C. DAVIS

An effective method for conducting experiments on dust inhalation. C. K. DRINKER, PHILIP DRINKER AND KATHERINE R. DRINKER. *J. Ind. Hyg.* 7, 440-3 (1925).—Addn. of 10% CO_2 to the dusty atm. increases the rate and depth of breathing of exptl. animals so that short exposures give uniform and satisfactory distribution of dust particles in the pulmonary alveoli. E. A.

Destruction of cockroaches and devitalization of their eggs by cyanogen-chloride mixture. C. E. RICE. *U. S. Public Health Repts* 40, 1808-11(1925).—Two, preferably 4 hrs.' exposure in a properly sealed ship to HCN and CNCI developed from 2 oz. NaCN to each 1000 cu. ft. with the necessary quantity of $NaClO_3$ and HCl will kill practically all croton bugs and their eggs unless they are too well protected. MARY JACOBSEN

Report on the investigation into the destruction of vermin by hydrogen cyanide, with special reference to bed bugs. R. NEWSTEAD, A. E. EVANS AND W. H. FORBES. *Ann. Trop. Med. & Parasitol.* 19, 91-118(1925) — For effective work a concn of 0.5% of the gas, acting for a period of 3 hrs., is essential. G.

IMHOFF, K.: *Taschenbuch der Stadtentwässerung*. Munich and Berlin: E. Oldenbourg. 90 pp. Reviewed in *Eng. News-Rec* 94, 1028(1925).

Disinfection of anthrax hides (PIRAS, PASCALE) 29. The mass treatment of goiter (LILL) 11H. Value as fertilizer of fermented and fresh sludge (SIERP) 15. High-Si irons and their application by the water works engineer (SCOTT) 9. HCN (Brit. pat. 230,346) 18.

Apparatus for deaerating water by steam treatment. J. R. McDERMET. U. S. 1,552,071, Sept. 1.

15—SOILS, FERTILIZERS AND AGRICULTURAL POISONS

J. J. SKINNER

Determination of incrusted cellulose in soil. N. BENGTSSON. *Medd. Central-anstalt. forsöksväsendet jordbruks*. No 279(1925).—Add 100 cc of a soln. which contains 80 g. $NaHSO_3$ and 200 cc 0.1 N HCl per l. to 20 g mineral soil plus the cellulosic substance placed in a securely stoppered 200-cc. flask and treat for 72 hrs. in a steam oven at 98° to 100° and for 192 hrs if the added substance is sawdust or moss. In the latter case add 50 cc. more of the $NaHSO_3$ -HCl soln after 96 hrs. Filter on hardened filter paper with a Buchner funnel, washing with water till colorless. Dry at about 50° and put into a 150-cc. Lovén flask. Shake for 1 to 2 hrs. with 100 cc. Schweitzer's reagent. Filter the following day through a porous-bottom crucible. Ppt. the cellulose in 50 cc. of the filtrate with 200 cc. of 80% C_2H_5OH and allow to settle. Transfer the ppt. to a porous-bottom crucible and treat with HCl and H_2O to remove Cu. Then wash with the following successively: 5% NH_3 , 2% HCl, H_2O , C_2H_5OH and $(C_2H_5)_2O$. Dry at 50° for 1/2 hr. to remove ether and alc., and then for 1 hr. at 100°. Transfer to a Pt crucible; weigh, ignite and reweigh. With peat soil use 10 g. of soil and treat with 100-150 cc. of the $NaHSO_3$ -HCl soln. After filtering wash with 0.2 N HCl till the filtrate is colorless then with three 15-cc. portions of water. After drying the sample at 50°, shake for 4 hours in a Lovén flask with 2 g. powd. CaO and 100 cc. of Schweitzer's reagent. After this the treatment is the same as that for mineral soil. C. O. S.

The soils of Ukraine. G. MAKHOV. *Vistiak Silsko-Gospodarskoi Nacuki* 3, 6-22(1924). V. KROKOS. *Ibid* 22-31; *Rev. internat. Enseign. agr.* 3, 476-80(1925).—A detailed description of the soils with a discussion of their origin and formation. A. PAPINEAU-COUTURE

The brown soils of Finland. B. AARNIO. *Rev. internat. rensign. agr.* 3, 433-40 (1925).—According to Ramann, brown soils, which predominate in Central Europe, are formed in temperate climates and the accompanying vegetation is that of deciduous trees. They are characterized by a dirty dark brown color due to Fe_2O_3 and humic

substances. They are soils which have lost their sol. salts (including carbonates and sulfates) by washing out, while the Fe and Al oxides and phosphates have been practically all left behind. The brown soil of Helgö-Småländ (Sweden) consists of 3 strata: (A) 0-3 cm., forest refuse, beech foliage; 3-15 cm., granular powder, very friable, containing many worms, passing gradually into (B) 15-55 cm., dirty brown soil with granular structure; (C) below 55 cm. moraine. Analysis of the 3 strata after air drying showed:

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	K ₂ O	Na ₂ O	H ₂ O	Humus	Total
A	65.42	0.53	19.97	2.51	1.98	0.09	2.77	3.16	2.49	9.96	99.21
B	79.99	0.59	11.96	3.31	1.41	0.12	3.19	3.12	1.95	3.96	99.62
C	72.90	0.55	12.25	3.18	1.84	0.15	3.16	2.88	1.17	1.98	99.18

According to O. Tamm, this soil is rapidly converted into ordinary gray soil, "podzol," when the beeches are replaced by conifers, indicating its formation to be due to the abundant fall of beech leaves. The soil in a wood of *Corylus avellana* at Laitila, in south-western Finland, consists of the following strata: (A) 0-7 cm. dark-colored light soil, rich in humus having a granular texture; (B₁) 7-17 cm., humus of a dirty auburn color; (B₂) 17-40 cm., brownish gray, contg. humus; (C) 40 cm. and deeper, moraine. There is no fuller's earth. Analysis of these layers after air drying showed:

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	K ₂ O	Na ₂ O	P ₂ O ₅	SO ₃	H ₂ O	Humus	Total
A	57.25	9.76	3.83	2.18	0.86	2.68	1.96	0.37	0.05	10.35	10.51	99.80
B ₁	66.55	10.50	3.91	1.70	1.27	2.46	2.65	0.18	..	5.02	5.49	99.79
B ₂	70.70	11.82	3.75	2.10	1.13	2.15	2.80	0.28	..	2.35	2.60	99.68
C	70.95	11.93	4.95	1.80	1.08	3.02	2.51	0.22	..	2.75	0.47	99.71

These analyses show the difference of this formation from that of "podzol": the sesquioxides have not accumulated in B; Al₂O₃ remains practically in equi.; while Fe₂O₃ has been partly washed out. K₂O, P₂O₅, and especially CaO are accumulated in A, which is very rich in humus. The proportion of the humus which is sol. in H₂O (0.78-7.03%) is greater in "podzol" than in brown soil, and intermediate in ferruginous "podzols." The concn. of humus in the soil soln. is very small (0.0205-0.6178 g. per l.) being greatest in "podzol" and least in brown soil. Formation of brown soils is due to the nature of the vegetation, abundant leave fall increasing especially the CaO content of the upper stratum, causing coagulation of the humic matter, and transforming it into slightly sol. substances. In that case the humus does not facilitate the washing out, and the "podzol" is not formed. Because of abundant formation of humus the upper strata have a high humus content, which does not, however, exercise a protective action. The CaO addn. to the soil due to the fall of leaves is much greater with beech and spruce than with pine; and as the evergreen needles decompose much more slowly than the deciduous leaves, the latter favors the formation of a more highly coagulated humus, which develops mainly in dry districts. When the level of the soil water is high, the CaO is washed out and the soly. of the humus increases. A. P.-C.

The nomenclature and classification of the mineral soils in Holland. (I.) **Definition of the terms clay, loam and sand.** D. J. HISSINK. *Verslag. Land. Onderzoek. Rykslandbouwprefsta.* No. 30, 169-202 (1925).—Clay, loam and sand are the products formed by the weathering of the minerals, which is essentially a pulverization and chem. transformation of the rock material, hence both mech. and chem. H. has followed the van Bemmelen method in the chem. analysis of a large number of Dutch clay and loam soils. A description of the method is given, and results of analyses are tabulated. The mech. analysis consists of 2 parts: the liberation of the particles and the segregation of these particles into groups of various dimensions. Particles smaller than 20 microns diam. run from 42.7 to 85.3%, and those greater diminish from 49.2 to 6.6%. Definitions in detail of sand, clay and loam according to H. are given. A detailed summary in English is given. J. C. JURRIJENS

The saturation condition of the soil. I. Mineral soils (clay soils). D. J. HISSINK. *Verslag. Land. Onderzoek. Rykslandbouwprefsta.* No. 30, 115-41 (1925).—The satn condition of the soil (V) means the proportion of exchangeable bases (S) and the amt. o bases which the soil can combine with by adsorption (T). $V = (100 S/T)$. It is necessary to det. the satn. point of the unsatd. acids of the soil (T - S). This is done by the elec cond. method. A 0.07 N soln. of Ba(OH)₂ was found to be the best alkali to use. There exists a coordination between the necessary amt. of lime for the pptn. of a watery suspension of clay and the satn. condition of the clay substance (V). Complete pptn occurred only at a V of about 95. As long as the clay soils contain CaCO₃, there is little change in the V and K values. Normal clay soils are divided in 3 groups in con

nection, with Ca treatment: (1) Soils rich in CaCO_3 , V value about 50–55, no Ca necessary; (2) soils with little or no CaCO_3 , V value about 50–55, in need of Ca; (3) soils with no CaCO_3 , V value less than 50, in need of Ca. An attempt has been made to det. the equiv. wt. of the clay substance. The values found lie between 1033 and 2061. The equiv. wt. of humus, found by electrometric titration of the acid, is about 180. There is a great difference between the equiv. wt. of the clay and humus substance. Several curves and tables accompany the article.

J. C. JURRJEENS

Investigation of the nature of the soils of the Biesbosch in South Holland. J. G. MASCHHAUPT AND D. J. HISSINK. *Verslag. Land Onderzoek. Rijkslandbouwproefsta.* No. 29, 110–36 (1924); *Expt. Sta. Record* 52, 618.—Phys. and chem. studies are reported, and the results are discussed and compared with polder samples. These soils are evidently well supplied, especially in the top strata, with total N, P_2O_5 , lime and org. matter and have a slightly alk. reaction. It is thought that after drainage they should possess a greater immediate cultural value than the polder soils. A brief list of the analytical methods of study used is presented.

Examination of soil- and dredge samples taken from the inland waters of Rijn and Sluipwyk, in connection with their intended reclamation. D. J. HISSINK, VAN DER SPEK, A. DEKKER, M. DEKKER AND H. OOSTERVELD. *Verslag. Land Onderzoek. Rykslandbouwproefsta.* No. 30, 307–35 (1925).—A detailed account of chem. analyses of a large no. of soil and dredge samples taken from these waters, as well as a description of the methods used.

J. C. JURRJEENS

Study of the soil solution. I. Methods for the preparation and examination of the soil solution. A. G. DOYARENKO. *J. für Landwirtschaftliche Wissenschaft (1924); Rev. internat. renseign. agr.* 3, 449 (1925).—The freshly procured soil sample, which should have a moisture content at least twice as great as its hygroscopic capacity, is carefully mixed with a definite quantity of perfectly neutral and chemically inactive oil (vaseline oil), so that the oil forms an emulsion with the soil soln. The soil soln. is obtained free from oil by pressing gently and centrifuging. The following detns. should be carried out: osmotic pressure, cond., degree of dissociation of the electrolytes, colloids, n , α , chemico-calorimetric tests, titration with KMnO_4 .

A. PAPINEAU-COUTURE

Variations in the soil solution during the vegetation period of fallow lands which have been worked differently. A. V. TROFINOV. *J. für Landwirtschaftliche Wissenschaft (1924); Rev. internat. renseign. agr.* 3, 459 (1925).—Samples of soil, taken in different parts of the exptl. field of the Academy of Agr., Moscow, during a dry spell and during a wet spell, were examd. by Doyarenko's method (preceding abstract). The concn. of the soil soln. increases towards the middle of the vegetation period, and decreases again towards the end. The concn. in bare fallow lands is approx. 3 times that of fallow land which was cleared late in the season. The osmotic pressure of bare fallows is 4–5 times that of soil which was plowed late, and reaches a max. during the vegetation period. Nitric N is greatest in the middle of summer, and is greater in bare fallows than in recently plowed soil. The relative K, Mg and Ca contents remain const. and exert a buffer action on the soil. There are more anions than cations. pH was approx. neutral in all cases, with an occasional tendency towards acid reaction, but always within the limits most favorable to plant life.

A. PAPINEAU-COUTURE

The preliminary treatment of soil with ammonia for the Atterberg analysis by elutriation. E. BLANCK AND F. ALTEN. *J. Landw.* 73, 39–43 (1925).—The authors had previously found that treatment of soil with 2.5% NH_3 preliminary to the Atterberg's mechanical analysis dissolved appreciable quantities of SiO_2 and CaO , which hereupon introduced an error. This solvent action is confined to soils in the acid regions which have a high salt content. The present paper deals with 15 very different German soils. From these soils the NH_3 treatment dissolved only slightly more than pure water.

F. M. SCHERTZ

The relation between properties and chemical composition of soil colloids. M. S. ANDERSON AND S. E. MATTSON. *Science* 62, 114–5 (1925).—Many of the properties of soil colloids, such as adsorption, heat of wetting, swelling, viscosity, base exchange, elec. behavior and particle size, show a close interrelationship. These properties appear also to correlate well with chem. compn. Data are given showing the correlation between heat of wetting, NH_3 adsorption and the mol. ratio $\text{SiO}_2/(\text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3)$. Certain other chem. constituents appear also to be more or less closely related.

M. S. ANDERSON

The colloidal content of soils. P. L. GILE. *J. Am. Soc. Agron.* 17, 270–5 (1925); cf. C. A. 18, 1355.—A brief summary of recent work in the U. S. Bureau of Soils concerning what material in the soil is colloidal; methods of estg. the colloid content of soils by detg. how the adsorption or heat of wetting of the whole soil compares with

that of a sample of the isolated colloid; the quantity of colloid in soils; and the homogeneity of the soil colloidal material. F. M. SCHERTZ

Climatic agencies in their relation to soil colloids. R. M. SALTER. *J. Am. Soc. Agron.* 17, 294-307 (1925).—The paper is concerned with the results of changes in state of soil colloids, i. e., the reciprocal changes of sols to gels and the changes which occur in the structure of gels. These changes are associated with drying and wetting, freezing and thawing and change in concn. of the ions of dissolved electrolytes. F. M. S.

The effect of the colloidal content upon the physical properties of soils. G. J. BOUYOUCOS. *J. Am. Soc. Agron.* 17, 285-94 (1925).—Colloids influence more or less or entirely control practically all the physical properties of soils. Colloids may be regarded as the most important part of soil. F. M. SCHERTZ

The significance of soil colloids in relation to plant feeding and conservation of essential elements. E. TRUOG. *J. Am. Soc. Agron.* 17, 280-5 (1925).—Soil colloids immediately remove an excess of the essential elements from the soil soln. after fertilization and also prevent leaching. The essential elements are not readily removed from colloids by drainage water because the water passes through the larger pores between the granules and not through the pores of the colloidal gels. Root hairs of plants come into very close contact with the gels and form a sort of colloidal union with them which makes possible a removal of the sol. elements in the water of the gel. Sandy soils, because of their low content of colloidal material, leach very readily. F. M. SCHERTZ

The chemical nature of colloidal clay. RICHARD BRADFELD. *J. Am. Soc. Agron.* 17, 253-70 (1925). See C. A. 18, 1356. F. M. SCHERTZ

Colloid determination in mechanical analysis. R. O. F. DAVIS. *J. Am. Soc. Agron.* 17, 275-9 (1925).—The presence of colloids in soils in greater proportion than was formerly believed has made it desirable to express the colloidal content in the mechanical analysis. The sepn. of the colloid by extn. with water is impracticable. The absorption of water vapor by soils is dependent on the colloidal material present and the amount of absorption is proportional to the colloid present. The av. absorption of 34 soil colloids over 3.3% H_2SO_4 is 0.3 g. of water per g. of colloid. By dividing the absorption per g. of soil by 0.3 the % colloid present may be detd. The method proposed is to carry out the sepn. of the sand sizes in a soil by the usual method, to det. the colloid content by water absorption method and obtain the silt by difference. F. M. SCHERTZ

Soil reaction and the need of lime. J. H. ABERSON, FRIDA EVERSMAAN AND J. W. VAN DIJK. *Landbouwk. Tijdschr.* 36, 345-68, 401-17 (1924); *Botan. Abstracts* 14, 478.—The views of Baumann and Gully that muck makes acid free from salts is not accepted. The difference between the action of uni- and bi-valent cations is made clear. The humic acids of muck and sand soils have the same equiv. wt. and therefore have probably also the same chem. compn. The theory of physiologically acid and alk. salts is not according to facts. The differences are based on the more or less rapid washing away of lime as a consequence of the decompn. of manures. The action of lime is in the first place neutralizing, and furthermore, influences the phys. and chem. properties of the soil and the life of lower organisms. Methods for detn. of the quantity of lime needed to neutralize acid soils are very different. The values vary and it is impossible to det. which one is best. The reaction of sand and muck soils is caused by humic acids and has much influence on the development of lower organisms. H. G.

A study of the reaction of Swiss soils. HANS JENNY. *Landw. Jahrb. Schweiz.* 39, 261-86 (1925).—The acidity of Swiss soils and the influence on plants as well as the significance of soil reaction in general are discussed. The acidity of the soils was detd. by the Comber method (C. A. 15, 2326; 16, 2750), by the method of Michaelis (C. A. 15, 1427; 16, 111, 773, 1101), and by means of azolitmin. Curves are given. The Michaelis and Comber methods agreed closely. The effects of the quantity of H_2O added and of buffer action are shown. O. L. E.

Determination of the buffer effect of soil. J. S. TORBORG. *Tidsskrift for Plantæavl.* 30, 565-85 (1924); *Rev. internat. renseign. agr.* 3, 450-1 (1925).—To det. variations in p_H of a suspension of 10 g. of soil in 100 cc. of liquid to which was added increasing quantities of 0.1 N HCl and $Ca(OH)_2$. The effect of $CaCO_3$ was studied by converting the $Ca(OH)_2$ by addn. of CO_2 in equil. with atm. pressure. According to N. Bjerrum and J. K. Gjaldbæk, the p_H of a liquid satd. with $CaCO_3$ is given by $-p_H = -5.02 + \frac{1}{2} \log c_{Ca} + \frac{1}{2} \log p_{CO_2}$, where c_{Ca} = mol. concn. of Ca ions and p_{CO_2} = CO_2 pressure in the liquid; so that a liquid satd. with CO_2 at atm. pressure has $p_H = 8.38$. The limit of p_H of a soil suspension to which are added increasing quantities of $CaCO_3$ is 8.4, provided it does not contain large quantities of alkali carbonates or other strong bases. If there is no addn. of CO_2 , partial conversion of $Ca(OH)_2$ will occur because of atm. CO_2 .

and the p_H will decrease according to the CO_2 pressure in the atm. p_H detns. were carried out also with a soil having no "buffer" effect, consisting of pure quartz sand. The p_H was plotted against the cc. of $Ca(OH)_2$ and of HCl in the case of the various soils examd.; and if there is no buffer effect the curve should coincide with that of the pure quartz sand. The value of the buffer effect of the soil on HCl over a given p_H range is given by the difference in length of the distances at which the standard curve and the curve for the soil in question cut the horizontal relating to the same p_H intervals. This difference in length gives the no. of cc. of 0.1 N HCl which can be fixed by 10 g. of the soil when the p_H decreases within the limits indicated by the interval.

A. PAPINEAU-COUTURE

Buffer action of some Burma soils. J. CHARLTON. *Mem. Dept. Agr. India, chem. ser.* 7, 101-21 (1924).—The buffer action of soils was detd. by shaking soil with varying quantities of acid and alkalies for 24 hrs., centrifuging the suspension and observing the p_H value of the supernatant liquid. Titration curves showing the relationship between added acid or alkali and p_H value may be used to det. the CaO requirement of the soil to bring its p_H value to any desired figure and also to measure the reserve buffer capacity of soils which are becoming increasingly acid. RUSSELL M. JONES

Hydrogen-ion concentration, buffer action and soil type as a guide to the use of lime. C. R. RUNK. *J. Am. Soc. Agron.* 17, 345-53 (1925).—Applications of lime made by the "lime requirement" method upon the Delaware Expt. Station fertility plots have in most instances shown no profits. However, increases in production were secured and it is felt that smaller applications based upon H -ion concn. and plant needs would have been economical. More work needs to be done upon the optimum p_H values for crops under field conditions, yet the present indications are that most of these values may fall between p_H 4 and p_H 6.

F. M. SCHERTZ

Universal indicator for the colorimetric determination of p_H values in the examination of soils. H. NIKLAS AND A. HOCK. *Z. Pflanzenernahr. Dungung* 3A, 402-5 (1924).—An indicator with a working range from p_H 3.5 to 7.6 can be made by mixing alc. solns. as follows: 1 vol. 0.01% bromocresol purple, 4 vols. 0.04% bromophenol blue, 6 vols. 0.02% methyl red and 4 vols. 0.04% bromothymol blue. The indicator in use gave results in close agreement with those obtained by the methods of Clark and Lubs and Michaelis.

A. L. MEHRING

Use of the quinhydrone electrode for the determination of the p_H of soils. CH. BRIOUX AND J. PIEN. *Compt. rend.* 181, 141-3 (1925).—Comparative results are tabulated of detns. made with the H and quinhydrone electrodes on soils of varied geological origin. The concordance obtained when working directly on suspensions of soil is not as good, in general, as that reported by Christensen and Jensen (*C. A.* 19, 369). The agreement is better when centrifugates are used, the p_H values obtained with the quinhydrone electrode running numerically slightly higher as a rule, but even then, in certain cases, unexplained deviations are encountered.

P. R. DAWSON

Improved tube for determination of decolorizing value of soils. D. V. MOSES AND J. H. GRIFFITH. *Ind. Eng. Chem.* 17, 901 (1925).

M. S. ANDERSON

Reciprocal action of ground phosphorite and soils not having an acid reaction. A. N. LEBEDIANTZEV. *Ann. sci. agron.* 41, 320-9 (1924); *Expt. Sta. Record* 52, 623.—Studies of the activity of ground phosphorite in fallow and cropped soils are reported. The results indicated the great importance of the biological activity of soil in modifying the availability of phosphorite. In the majority of cases the action of phosphorite added directly previous to planting was more pronounced than that of phosphorite added to fallowed and subsequently cropped soil. The results are taken further to indicate that the P_2O_5 of phosphorite becomes available in soils much more easily than has hitherto been thought, but that it may again be rendered insol. by chem. and biological action. Phosphorite was also found to be quite sensitive to the action of the desiccation, reacting more markedly to this influence than basic slag or superphosphate. Since desiccation apparently exercises its main influence on org. compds. in soils and has little influence on mineral compds., it is thought that the greater part of the P_2O_5 of phosphorite passes into org. combination. The results in general indicate that the P_2O_5 of phosphorite is inherently much more mobile under soil conditions than that of superphosphate or basic slag.

H. G.

Exchange of the aluminium ion in soils of different types for the potassium ion of a neutral salt. LADISLAS SMOLIK. *Compt. rend.* 180, 1773-6 (1925).—The exchangeable Al was detd. by mech. agitating 30 g. of soil with 100 cc. of a normal soln. of KCl for 1 hr., detg. the Al_2O_3 in the filtrate and subtracting from this value the Al_2O_3 detd. in the filtrate from agitating an identical sample with 100 cc. of distd. H_2O . Exchangeable Al was found in all layers of a large no. of soils of the podsol type, forest as well

as tilled, ranging from 21.1 to 229 mg. per 100 g. of dry soil. None was found in soils of the redzina or tchernozem types. P. R. DAWSON

Comparative examination of some methods for the determination of phosphoric acid in soils. D. J. HISSINK AND M. DEKKER. *Verslag Land. Onderzoek. Rykslandbouwproefsta.* No. 30, 142-61 (1925).—A description is given in detail of several methods for the detn. of P_2O_5 in soils as used in Holland and results are tabulated. The methods recommended by the authors for the detn. of acid-sol. and citrate-sol. P_2O_5 are given. J. C. J.

Replaceable bases in soils. W. P. KELLEY AND S. M. BROWN. *California Agr. Expt. Sta., Tech. Paper* 15, 39 pp. (1925).—The replaceable bases of several neutral or slightly alk. soils from California are composed mainly of Ca, Mg in smaller quantities, and very small quantities of K and Na. Alkali soils are characterized by a relatively large amt. of replaceable Na and a correspondingly low amt. of replaceable Ca. The acid soils examd. are characterized by a low total content of replaceable bases, and by the presence in replaceable form of Al, Fe or Mn. Acid soils have the power to absorb large amts. of $CaCO_3$, a part of which may enter into replaceable form. The H of carbonic acid may be substituted for a part of the replaceable bases. Dil. HCl displaces the bases, but may attack other constituents. The replaceable bases are considered to be present not in a state of phys. absorption, but as chem. compds., probably as complex aluminosilicates which have been formed through weathering. J. J. S.

Significance of base exchange in soils for plant growth and the influence of lime on the absorbing material in soil. A. VON NOSTITY. *Landw. Vers. Sta.*, 103, 159-77 (1924).—The effect was studied of supplying Ca, Mg and K to plants either as sol. salts or as Ca, Mg and K permutites, the permutite complexes being considered a near approach to the naturally occurring zeolites which are the chief absorbing material in the soil. Sand cultures of barley, rye, mustard and other plants were used. With barley the yield was least when Ca, Mg and K were all supplied as sol. salts. When all the bases were given in an absorbed condition (as permutites) both yield and root growth were very much better and the more favorable conditions were found to be those when Ca and Mg were present as sol. salts and K was present as permutite. The ash content of the plants was also highest under these conditions. Assuming the behavior of permutite to be analogous to that of the zeolitic silicates of the soil, it is considered probable that absorbed basic nutrients become available to the roots of plants by decompn. of the absorbing material of the soil, but that without base exchange, the minerals obtainable in this manner in ordinary arable soils would scarcely suffice for plant growth. Similar expts. with permutites in presence and absence of lime lead to the conclusion that, by setting free other nutrients by base exchange, lime delays decompn. of the zeolitic silicates of the soil and tends to preserve its absorptive capacity. B. C. A.

A biological measurement of the availability of potassium in soils. D. E. HALEY. *Pennsylvania Agr. Expt. Sta., Bull.* 188, 8 pp. (1925).—By means of the water extn. method it is shown that soils treated with K over a period of years contained no more water-sol. K than soils in the same vicinity receiving no K. J. J. SKINNER

Adsorption of dyes by soils. J. A. WILKINSON AND WILBUR HOFF. *J. Phys. Chem.* 29, 808-15 (1925).—Expts. on the adsorption of diamine blue 3B, methylene blue and neutral violet by a series of 6 soils lead to the following conclusions: The adsorption of dyes by soils and clays is of the same nature as the dyeing of fibers. The amt. of dye taken up may be increased or decreased by varying the acidity or alk. of the soln. 95% of the total dye adsorbed will be taken up during 1 hr. of steady shaking. There is some evidence of base exchange between the dyes and the basic elements in the soil. P. R. DAWSON

Recent progress in the study of soil microorganisms. LUCIEN LEROUX. *Rev. gén. sci.* 36, 464-9 (1925).—A review with bibliography. E. J. C.

Azotobacter in the soils of Finland. WIDAR BRENNER. *Geolog. Komm. Finland Agtogeolog. Meddel.* 20, 1-15 (1924); *Botan. Abstracts* 14, 478.—Among 200 soil samples taken in various parts of Finland only 2 contained *Azotobacter*. That this bacterium is very rare in Finland is indicated by the high acidity and weak buffer action of both the cultivated and the virgin soils of Finland. After inoculation *Azotobacter* developed in occasional instances in soils with pH 5.8-6.0 while the limit commonly appears to be about pH 6.7. Some soils, particularly the Fe oxide layer of the podsol profile, have a toxic effect on *Azotobacter* independently of their reaction, as they check its development even after the addn. of $CaCO_3$. H. G.

Soil inoculation with *Azotobacter*. P. E. BROWN AND W. J. HART. *J. Am. Soc. Agron.* 17, 456-73 (1925).—Small quantities of N increased the N-fixing power of *Azotobacter chroococcum*, *vinelandii* and *beijerinckii* in cultural solns. Inorg. forms

N were more stimulating than org. forms. Inoculation of the soil with *Azotobacter* is not yet practical but indications point to a future practical utilization of this method of increasing and maintaining the N content of soils. Wheat yield was not increased by inoculation with *Azotobacter* although N accumulated in the soil. F. M. SCHERTZ

• The predominance of activity of anaerobic nitrogen fixers in the soil. GEORGES TRUFFAUT AND N. BESSONOV. *Compt. rend.* **181**, 165-7 (1925).—Eight flasks of 2 l. capacity, contg. 150 g. of soil, were treated with 900 cc. of a soln. contg. 0.642% glucose, with the addn. of 15 g. CaCO_3 to correct acidity. Half of these received for 14 days a current of air freed of NH_3 ; half received a current of N, likewise freed of NH_3 . Further, half of each of these 2 sets received mineral nutrients besides the CaCO_3 . The rate of fixation of N was almost doubled in all cases where anaerobic conditions prevailed.

P. R. DAWSON

Bacterial nitrogen fixation. P. LOHNIS. *J. Am. Soc. Agron.* **17**, 445-50 (1925).—

• Inoculation of the soil with active non-symbiotic N bacteria has failed because the dominating influence of the environmental conditions was not properly considered. The value of bacterial N fixation is discussed. F. M. SCHERTZ

The fixation of nitrogen under field conditions. J. G. LIPMAN. *J. Am. Soc. Agron.* **17**, 450-5 (1925).—The problem of N fixation under field conditions is so vast and many-sided as to assume the proportions of a major factor in our national economy. More efficient types of legumes and bacteria both symbiotic and non-symbiotic must be sought, for commercial N can supply only a small fraction of the N requirements of crops. F. M. SCHERTZ

The influence of bacteria on the process of solution of phosphate in the soil. J. STOKLASA. *Centr. Bak. Parasitenk., II Abt.* **61**, 298-311 (1924); *Abstracts Bact.* **8**, 392.—The development and reproduction of bacteria in the soil depend upon the amt. of available P. By adding N or inoculating the soil with *Azotobacter*, the activities of the soil bacteria are stimulated, more CO_2 is formed and more P goes into soln.

H. G.

The effect of nodule-formation and seed-production of growing soy beans on soil treated with sulfur dioxide. L. T. LEONARD AND S. H. NEWCOMER. *J. Am. Soc. Agron.* **17**, 309-12 (1925).—Treatment of field soil with SO_2 and HCHO in 1% concns. showed that the nodule formation was inhibited on the upper parts of the roots of Peking soy beans. Sulphorm, a combination of SO_2 and HCHO , when applied in the same concn., did not inhibit nodule formation to a like extent. Sulphorm-treated plots gave 20% more seed than did controls.

F. M. SCHERTZ

• The effect on soil phosphorus of rice culture. E. C. URETA. *Philippine Agr.* **14**, 173-83 (1925).—Two crops of rice removed 6.22% of the P_2O_5 present in unfertilized soil. 45.8% of the total amt. of P_2O_5 added was fixed by the soil and 51.8% was lost, presumably by leaching. A fairly large part of the P_2O_5 sol. in strong acid appears to have been converted to a less sol. form by cropping. The 0.2 N HNO_3 -sol. and H_2O -sol. P_2O_5 remained nearly const., while the total P_2O_5 diminished. It appears, therefore, either that the P_2O_5 is converted to an easily sol. form at about the same rate that it is being used by the plant, or that rice can utilize it in a form not generally considered available.

A. L. MEHRING

Utilization in the soil of the nitrogen of manure. CHR. BARTEL. *Kgl. Landbruks Akad. Handl. Tid.* 1925; *Rev. internat. renseign. agr.* **3**, 468-9 (1925).—From previous observations B. concludes the increase in microorganisms brought about by application of manure has no effect on the microflora of the soil, as the conditions of this microflora have generally been established anteriorly. Manure has an indirect, rather than a direct, biological action. Only the NH_3N of the manure is nitrified during the first year. On the other hand, org. N is decomposed very slowly, as shown by expts. with manure contg. no NH_3 . NH_3 is of great importance in the decompn. of cellulose; but this is an indirect effect of manure, which does not directly accelerate the decompn. by supplying the organisms which cause the decompn. of the cellulose!

A. PAPINEAU-COUTURE

Importance for plants of nourishment having exchangeable bases, and action of lime on the absorbing components of the soil. A. V. NOSTITZ. *Landwirtschaftliche Versuchsstationen* **103**, 159 (1925); *Rev. internat. renseign. agr.* **3**, 473 (1925).—When no exchange of bases is possible the nourishment combined with bases becomes available to the roots only through the attack of the absorption agents, and consequently the absorption power of the soil is diminished. This attack takes place fairly rapidly as long as zeolitic compds. are present; but the quantity of easily attacked compds. is very small. The arable stratum generally does not contain Al silicates combined with bases, so that, unless there is an exchange of bases, the nutritive substances fixed in

the soil by absorption are not sufficient for the proper nourishment of the plants. Adequate CaCO_3 content of the soil exerts a buffer action by preventing decompn. of hydrated Al zeolitic compds. and thus helps to preserve the absorption power of the soil.

A. PAPINEAU-COUTURE

Assimilation of potash by young rye plants in a disproportionately small volume of soil. M. TSCHENHAGEN. *Botanisches Archiv* 7, No. 5-6(1924); *Rev. internat. renseign. agr.* 3, 547-8(1925).—T. studied the course of assimilation of nourishment by young plants cultivated under abnormal conditions, and compared the yields obtained. The dry yield, considered as a function of the increasing K_2O dressing, follows the law of the action of the development factors. For a given K_2O content of the soil its assimilation depends not only on the quantity present but also on the other development factors. The effect of light is of secondary importance, while the av. temp. (11.3°) was apparently one of the favorable factors. Const. concn. of the soil is an important requirement for max. K_2O assimilation. When nourishment is supplied in an easily sol. form, it is rapidly assimilated, irrespective of the development of the plant. The chem. development factors have a direct effect only insofar as their presence directly affects the assimilation of K_2O . Assimilation is a function of the concn. rather than of the total quantity of K_2O supplied so that the value of a soil cannot be judged merely from the total quantity of nourishment which it contains.

A. PAPINEAU-COUTURE

The action of salt solution upon certain seeds of cultivated plants. EUGENE MARRE. *Compt. rend. agr. France* 14, 636-7(1925).—Resistant and sensitive seeds are classified according to their sensitivity to 30% salt solution.

F. M. SCHERTZ

The influence of external factors on potato tubers. HANS NEUMANN. *J. Landw.* 7, 38(1925).—Increase in wt. of the potato is correlated with increase in length. Fertilizers influence the form of the potato. N causes the potato to lengthen. K-P fertilizers and increased moisture cause the tubers to thicken. A well-aerated soil is believed to produce short potatoes. Sandy soils tend to produce a short potato while heavy soils produce longer ones. Stable manure produces shorter potatoes than those unfertilized. A correlation has been found between long cylindrical forms and low starch content and short forms and high starch content. The size of the lenticels is increased by a greater water supply.

F. M. SCHERTZ

Effect of manganese on growth of wheat. J. S. MCHARGUE. *Fertilizer Green Book* 6, No. 9, 17-20(1925).—An exptl. study of the effect of Mn on the growth of wheat, and the wt. of grain and straw produced was made in a series of pot tests. A high-grade sandstone, contg. only a very slight trace of Mn, was used and to this were added the necessary nutrient materials in the form of pure chemicals. In addn. to the check pots Mn in the form of carbonate was used in varying amts. Data are given for the effect on total wt. of grain, wt. of straw and wt. of individual grain. Addn. of Mn slightly increased the amts. of N and protein present in the whole grains and decreased the amts. of P_2O_5 and K_2O . Approx. 2 to 3 times as much Mn was present in grain receiving applications of Mn as in grain from the check pots. The plants receiving Mn showed normal development of chlorophyll, while those from the check pots were pale green and decidedly less vigorous. Similar results as to the effect of Mn were obtained with plants grown in water cultures. An improved device for supporting plants during growth in water cultures is described. Six samples of basic slag contained 3.3 to 6.16% Mn while the amts. in agricultural limestone and rock phosphate were negligible.

K. D. JACOB

Intensive fertilization of turnips. H. WERNER. *Kali* 19, 265-8(1925).—Results are given for various combinations of NaNO_3 , kainite and superphosphate. The greatest increase in yield was obtained with a 5/5/4 mixt. of the above (expressed in 100 kg./hectare), but a 3/10/4 mixt. gives only slightly lower yields and is very much cheaper.

WM. B. PLUMMER

The most effective nitrogenous fertilizer for sugar beets. P. WAGNER. *Deut. Zuckerind.* 50, 358-60(1925).—For 360 kg. NaNO_3 per hectare the av. increase in yield is 24.5 kg. beets per kg. NaNO_3 . The same wt. of N in ammonia salts produces 62% as much increase.

W. L. BADGER

Nitrogen losses in cow urine. HENRY DORSEY. *J. Am. Soc. Agron.* 17, 489-92(1923).—Urine kept in jars during the summer lost less than 50% of its N. A layer of kerosene reduced the loss of N about 40%. The use of acid phosphate increased the loss of N.

F. M. SCHERTZ

The value as fertilizer of fermented and fresh sludge. FR. SIERP. *Tech. Gemeindeblatt* 27, 16, 33(1924); *Bull. mens. office intern. hyg. publ.* 17, 557(1925).—Fermented sludge was best on clay soils. It contains less water and is easier to handle because more fluid. Fresh sludge ferments in the soil, giving off H_2S . Many weed seeds

as well as objectionable bacteria and material attracting flies and supporting their larvae are destroyed during the fermentation.

JACK J. HINMAN, JR.

The results of tests of plant-protecting agents in the years 1921-24. A. KÖLLIKER. *Chem.-Ztg.* 49, 654-5, 674-5 (1925).—The results are summarized of tests on the phys. characteristics and insecticidal or fungicidal value of a large no. of com. spray and dust preps. on the German market.

P. R. DAWSON

Quantitative studies on the efficiency of fungicides. JEAN MACINNES. *Phytopathology* 15, 203-14 (1925).—Comparisons of the efficiency of HgCl_2 , CuSO_4 and HCHO as killing agents for *Apergillus niger* were made by employing alterations in elec. cond. of a mass of the fungus filaments as a criterion of death. The fungus was held between rubber disks in a glass cell and perfused with the killing agent; dftns. of the elec. resistance were taken at short intervals over a number of hours. With CH_2O there was at all concns. an initial rise in resistance followed by a gradual fall, which increased in rate with concn. With CuSO_4 there was a slight initial rise with concns. less than 0.05 *M*, followed by a rapid fall; with greater concns. there was an immediate fall. With HgCl_2 in low concns. (0.0006 *M* to 0.0016 *M*) there was a rise followed by gradual fall; in higher concns. there was an abrupt drop, followed by rapid and large rise and gradual fall. The expts. were usually terminated after 6-7 hours, when the resistance had fallen to 60-75% of that of the fresh material.

JOSEPH S. CALDWELL

The comparative value of carbon disulfide and other organic compounds as soil insecticides for control of the Japanese beetle. W. E. FLEMING. New Jersey Agr. Expt. Sta., *Bull.* 410, 3-29 (1925).—Forty-six org. compds. were studied to det. their effect on the beetle. CS_2 emulsified in water and so interspersed throughout the soil appears to be the compd. best adapted of those studied for freeing the soil about the roots of nursery stock of possible infestation of the Japanese beetle. By using scarlet sage, pot marigold, pine and juniper as an index of the effect on plants of pouring solns. of the various toxic compds. about the roots, it was found that CS_2 and naphthalene were the only ones that could be used safely to destroy infestation. The compds. having high toxicity towards beetle larva are benzyl chloride, naphthalene, sodium cyanide, hexachloroethane and CS_2 ; medium toxicity, bromobenzene, *p*-dichlorobenzene, chlorobenzene, *o*-nitrobenzene, phenol and *l*-creosol; low toxicity, *o*-toluidine, aniline and *m*-cymene. Seventy-five references to literature are given.

J. J. SKINNER

A nonstratifying carbon disulfide emulsion. W. E. FLEMING. *Ind. Eng. Chem.* 17, 1087 (1925).—A concd. mixt. of CS_2 , EtOH , *K* oleate and refined cottonseed oil makes a nonstratifying emulsion. It should be dild. with an equal vol. of water before mixing with the larger quantity of water for insecticidal treatment.

W. H. BOYNTON

Fumigation of potting soil with carbon disulfide for the control of the Japanese beetle. W. E. FLEMING. N. J. Agr. Expt. Sta., *Bull.* 380, 5-45 (1923).—The min. lethal dosage of CS_2 for Japanese beetles is 0.04 g. per l. of air at temps. from 50° to 80° F. The relative humidity of the air had no effect on the toxicity of the CS_2 fumes. In wet or cold soil CS_2 is ineffective but the results in air and air dried soil are very similar. Best results were obtained by treating 1 cu. yd. of soil with 1 lb. CS_2 for 48 hrs. in a tight wooden box at or above 50° F. When so used it had no effect on subsequent plant growth. A bibliography of 77 citations is appended.

A. L. MEHRING

A field test of mercuric chloride solutions in potato seed treatment. L. J. CROSS. *Phytopathology* 15, 241-2 (1925).—In order to maintain the concn. of a HgCl_2 soln. in which seed potatoes are being treated, the soln. is titrated from time to time against *KI* soln., 5 g. per l.; 25 cc. of this should give a clear end point with 50 cc. of 1 to 1000 HgCl_2 soln.

JOSEPH S. CALDWELL

Determination of sulfur fungicides on foliage. H. W. FITCH. *Phytopathology* 15, 351-4 (1925).—S present on the foliage is detd. by washing the leaves in CCl_4 , filtering hot, evapg. the filtrate to dryness and weighing. The area of the leaves employed is detd. by a planimeter. Forty leaves having an area of 186.7 sq. in. should have a minimum of 30 to 40 mg. of S to insure protection; treatment should be repeated when the quantity present is less than this.

JOSEPH S. CALDWELL

Argenical injury of the peach. C. M. HAENSELER AND WM. H. MARTIN. *Phytopathology* 15, 321-31 (1925).—Premature defoliation, canker and gummosis of young twigs in peach, which have become prevalent throughout New Jersey orchards, are in considerable part consequences of the use of arsenate of lead alone, with atomic S, or in dry-mix lime sulfur. There was no injury from standard self-boiled lime sulfur plus arsenate except when the proportion of lime was decreased or that of arsenate increased.

JOSEPH S. CALDWELL

to apple. H. C. YOUNG AND R. C. WALTON. *Phytopathology* 15,

405-15(1925).—The chief types of spray injury are described and illustrated in color. These may in part be due to mechanical injury to the lower epidermis by the force of the spray, but chiefly to sol. compds. of the spray. Retardation of the change of lime sulfur to CaSO_4 and pptd. S may result in burning by the sol. sulfides. Climatic factors, chiefly high temp., may accelerate injury by sol. materials both chemically and physically.

JOSEPH S. CALDWELL

The amount of strychnine in poisoned finches. J. V. CUTLER. *J. Dept. Agr. Union S. Africa* 11, 124-7(1925).—The av. amts. of strychnine found in finches poisoned with a bait composed of 1.5 lb. of flour paste in H_2O , 1 ounce of strychnine alkaloid, and 50 lb. of wheat, were 0.37 mg. in the entire bird and 0.27 mg. in the entrails alone. Ingestion of a sufficient no. of the poisoned birds to prove fatal to human beings and domestic animals is not considered probable but their careful collection and disposal are urged.

K. D. JACOB

Survey of the turpentine industry for possible larvicidal substances. M. E. BARNES. *Am. J. Hyg.* 5, 309-14(1925). The only substances possessing effective larvicidal action found in connection with the turpentine industry were turpentine, which is too expensive for anti-mosquito work and pine oil. The latter is effective against both anophelae and culicine larvae.

G. H. S.

Toxic action of oil films upon mosquito larvae with particular reference to pine oil films. M. E. BARNES. *Am. J. Hyg.* 5, 315-29(1925).—Pine oil has a powerful soporific or paralyzing effect upon mosquito larvae and pupae. For purposes of mosquito destruction a mixt. of pine oil and crude oil (1:9) is more effective than is either ingredient alone.

G. H. S.

The behavior of seed disinfectants containing mercury. S. BEIN. *Chem.-Ztg.* 49, 537(1925).—The marked hygroscopicity of such preps. as "Germisan," "Uspulin" and "Agfa-Beize" was demonstrated by expts. They should be preserved in tightly closed sheet metal containers.

P. R. DAWSON

Disinfection of cotton seed by means of carbon disulfide. E. FERREIRA. *Gaceta Algodonera* 1, No. 9, 21-5(1924); *Rev. internat. renseign. agr.* 3, 556-7(1925).—From results of tests in which he used 400 g CS_2 per cu. m. of seed for 24 hrs., F. concludes: the CS_2 treatment in no way injures the germinative power of the seed; it prevents fermentation of weak seeds which, though they did not germinate, might cause the development of a harmful vegetation, disinfection should be carried out a short time before sowing, the seed should be quite dry and quite ripe when disinfected. The method of detg. germinative power is described.

A. PAPINEAU-COUTURE

Loos, H.: *Bijdrage tot de kennis van eenige bodemsoorten van Java en Sumatra*. 218 pp., 15 cuts. Wageningen, 1924. Reviewed in *Arch. Suikerind.* 33, 503-5(1925).

Fertilizer. B. F. HALVORSEN and O. RAVNER. U. S. 1,551,824, Sept. 1. Leucite or other similar easily decomposable rock contg. K is mixed with HNO_3 in such amt. and concn. that a pulverizable product is obtained after reaction is completed.

Fertilizer. C. E. KREBS. Can. 248,488, April 7, 1925. The acid gases escaping from the concn. of waste sulfate liquor are absorbed in phosphate material, the material is treated with the concd. liquor and the mixt. is subjected to combustion.

Fertilizer and insecticide. C. ILLINGWORTH and H. H. DUCKWORTH. Brit. 230,148, Nov. 29, 1923. A damp pulverulent insecticide and fertilizer comprises wood ashes, soot, lime, S and "Diesel oil."

Insecticides. W. SCHMITZ. Brit. 230,203, Dec. 19, 1923. See Can. 247,378 (C. A. 19, 2385).

16—THE FERMENTATION INDUSTRIES

C. N. FREY

Latest investigations in yeast and fermentation. EMIL BAUER. *Am. Food J.* 20, 351-3(1925).—A review. J. A. KENNEDY

Bacteria-free fermentation. M. RUDIGER and M. DIEMAIR. *Z. Spiritusind.* 48, 240(1925).—The diastase soln. is sterilized by the addn. of HCHO . The greater the percent. of malt the less dextrin is formed. Cutting the usual malt addn. by $\frac{1}{6}$ still gave a good ratio of maltose to dextrin. A bacteria-free fermentation is more satisfactory and easier to control because of less contamination.

C. N. FREY

The regulating mechanism during fermentation. J. GRÜSS. *Wochschr. Brau.* **42**, 93-6 (1925).—Tests were developed for oxidase and reductase activity in yeast. These enzymes are antagonistic. Oxygenase may be demonstrated by means of violamine. NaCl inhibits the enzyme activity concerned with fermentation. Glycogen is produced from cane sugar, fructose or glucose. Yeast does not ferment glycogen when cane sugar is present and glycogen disappears rapidly at 37° especially if O_2 is present. Bakers' yeast ferments galactose slightly, but not arabinose. C. N. FREY

The utilization of nitrogen in wort by yeast during fermentation in the production of beer. W. WINDISCH. *Wochschr. Brau.* **42**, 123-4, 127-8 (1925); H. F. E. HULTON AND J. L. BAKER. *J. Inst. Brewing* **31**, 185 (1925).—The keeping qualities in relation to N content of beer, the degree of assimilation of the residual N, and the development of acid-forming bacteria were investigated. No relation between keeping quality and N content was found. C. N. FREY

The influence of nickel mash tubs on the acidity, hydrogen-ion concentration and color of wort. B. LAMPE. *Wochschr. Brau.* **42**, 145-6 (1925).—Nickel-lined tubs darken the wort and are, therefore, undesirable. C. N. FREY

The souring of grain mashes. P. C. POULSEN. *Wochschr. Brau.* **42**, 91-3 (1925).—Acidity may be developed by addition of CaSO_4 , by the condition of the malt used and by means of *B. delbrücki*. The proper amt is controlled by p_{H} measurements and by analyses of the original H_2O used. C. N. FREY

The determination of color in analyzing malt. VICTOR BERMANN AND LEO LAUFER. *Wochschr. Brau.* **42**, 169-70 (1925).—The method is based on Ostwald's theory of color and depends on the fact that if a pure white card and a pure blue one are observed in blue light, the color appears the same, but if the blue contains some black, the color is darker than that of the white card. If the blue contains some white, it will appear lighter, colored than the blue card in yellow light. The colors can then be expressed in terms of a standard. C. N. FREY

The determination of diastatic power in malt and in malt extracts. W. WINDISCH AND P. KOLBACH. *Wochschr. Brau.* **42**, 139-41 (1925).—A detailed description of the method is given. C. N. FREY

Methods for determining the diastatic power of malt extracts. F. DUCHACEK AND W. L. ZILA. *Wochschr. Brau.* **42**, 77-8, 81 (1925).—A review of the more recently developed methods is given. C. N. FREY

The bitter principle of hops. W. WINDISCH. *Wochschr. Brau.* **42**, 112-3 (1925).—The work of Wallmers and Wieland is discussed. C. N. FREY

A rational nomenclature for the bitter principle of hops. PAUL KOLBACH. *Wochschr. Brau.* **42**, 21-4 (1925).—A history and description of the isolation of the active principle of hops is given. C. N. FREY

The antiseptic action of hops and of the bitter principle of hops. PAUL KOLBACH. *Wochschr. Brau.* **42**, 61-4, 67-9, 73-4 (1925).— α -Lupulonic acid is 4 times as toxic as the β . A review. C. N. FREY

The newer discoveries relative to the use of hops in breweries and their usefulness in building up the hop industries. E. LOIBLE. *Wochschr. Brau.* **42**, 64-6, 69-71 (1925).—A discussion of methods of using hops. C. N. FREY

Studies relating to the acetone-producing organisms. G. J. FOWLER AND V. SUBRAMANYAN. *J. Indian Inst. Sci.* **8A**, 71-83 (1925).—The spores of the Weizmann bacillus were viable after 7 years in maize mash in sealed tubes. A modified Van Slyke procedure for acetone in wine was used. Since it has been found that starch is the best material for acetone production attempts were made to follow acetone production with starch decompn. products. Amylodextrin seemed to be more preferred by the organism than the less complex isomaltose. The acetone organism was found to grow better in the presence of the insol material in the mash. The acetone-producing organisms are wide-spread in nature. F. W. TANNER

Mahua flowers as raw material for the acetone-fermentation process. A. G. GOKHALE. *J. Indian Inst. Sci.* **8A**, 84-7 (1925).—Fresh undried mahua flowers gave the greatest yield of acetone in the shortest time. Dried flowers gave a good yield but the fermentation time was longer. Addition of starchy materials did not appreciably affect the fermentation. Concns. of 10-12% of mash inhibited fermentation. F. W. TANNER

The detection of added sugar from beet products in spirits by means of micro-distillation. M. RUDIGER AND F. GOERCHL. *Z. Spiritusind.* **48**, 261-2 (1925).—A discussion illustrated with tables is given. C. N. FREY

The low ashes of the Tuscan virgin white wines of 1923. GIUSEPPE DE ASTIS. *Atti accad. Georgofili* [5], **21**, 175-9 (1924).—Analyses of 16 such wines gave 11.4-13.2%

alc., 0.555–0.795% acidity, 1.576–2.066% ext., 0.92–1.50 g. ash per l. (4.45–8.16% of the ext.) and 0.055–0.109% K_2O . Analyses of similar wines for 20 yrs. have shown 1.27–2.00 g. ash per l., with a general av. of 1.50–1.60 g. per l. The lowness of ash for

plication of the yeast which removed most of the mineral for its own cells and (3) high alc. content which, together with the intense cold of the following winter, caused an abundant pptn. of cream of tartar. ALBERT R. MERZ

Comparative results of analyses of spirits and brandies. F. FEVRIER. *Union S. Africa, Dept. Agr. Sci. Bull. No. 37*, 2-8(1925) — A discussion with tables showing results of analyses of various spirits and brandies is given. The physiol. activity of the various fractions is also discussed. C. N. FREY

The wines of Cheateuneuf-du-Pape (France) of the 1924 vintage. JEAN BORDAS. *Ann. fals.* 18, 414–8(1925).— Analyses of 9 wines are tabulated and commented on. A. PAPINEAU-COUTURE

Effects of sulfurous acid on the behavior of bottled white wines. DUBAQUIÉ. *Ann. fals.* 18, 418–22(1925).— Cloudiness is due to slight attack of the glass by SO_2 with formation of traces of Fe^{++} and Cu^{+} sulfites, which give complex colloidal ppts. with pectic compds. in the wine. In presence of air the insol. Fe^{++} and Cu^{+} pectic compds. are oxidized to stable, sol. Fe^{+++} and Cu^{++} compds. Pptn. of Fe^{++} and Cu^{+} compds. by albumin is retarded by small quantities of SO_2 , which exert a solvent action on the albuminous compds.; and the latter after pptn. are not dissolved by aeration. A. PAPINEAU-COUTURE

The role of acidity in the preparation and the conservation of wine. LINDET. *Compt. rend. agr. France* 11, 474–6(1925) F. M. SCHERTZ

Deterioration of the foaming quality (of beer) due to iron. J. RAUX. *Brasserie et malterie* 15, 481–4(1925) — Loss of foaming quality and of flavor were traced to the presence of relatively large quantities of Fe which came from an enameled steel tank for SO_2 soln. in which the enamel proved defective. Loss of proper foaming quality is due to unstable, colloidal Fe-albuminoid compds. which are easily pptd. by the disturbance caused by evolution of the CO_2 of the beer. A. PAPINEAU-COUTURE

Defecation of the must of apples. E. KAYSER AND H. DELAVAL. *Compt. rend.* 180, 1966–8(1925).—Coagulation of the must of apples is more rapid at 40° to 48° than at ordinary temps. and is favored at both 17° and 48° by the addn. of barley malt. Ten-cc. samples of must were treated as follows: (A) control, with no addns.; (B) addn. of ext. of malt not heated (amylase + coagulase); (C) addn. of malt heated to 65° (coagulase destroyed); (D) addn. of 0.5 cc. ext. of malt heated to 65° (amylase) + 0.5 cc. ext. of barley not heated (coagulase); (E) addn. of 1 cc. of ext. of barley (coagulase alone). The maceration of malt and barley was made in the presence of toluene to avoid the action of microorganisms. (A) and (C) remained turbid for 48 hrs. both at 17° and 48°. The other tubes were clear in 24 hrs. at 17° and in 12 hrs. at 48°. The degree of ionization, the buffers and the variety of apples play an important role in the defecation. L. W. RIGGS

Industrial alcohol and by-products from raisins. A. W. ALLEN. *Chem. Met. Eng.* 32, 675–8(1925).—The plant with its equipment to ferment raisins or molasses is described. The products produced are alc., CO_2 , ether and unfermentable residues from the raisin, from which K bitartrate may be extd. The plant has a capacity of 30,000 gals. of alc. per day. The yeast grown is sold as chicken feed. C. N. FREY

Problems of the chemistry of hops (KOLBACH) 11D. Determination of volatile organic acids (BOHANNES) 7.

• **Butyl alcohol.** F. BOINOT. *Can.* 253, 511, Sept. 8, 1925. Lactic acid compds. are gradually brought under the influence of carbohydrate mash in active butyl acetone fermentation.

Acetone and butyl alcohol. G. W. FREIBERG. *U. S.* 1,551,550, Sept. 1. In bacterial fermentation of a carbohydrate mash to produce acetone and $BuOH$ at a temp. of about 37°, the temp. of the mash is lowered to about 30–35° when a tendency to acid fermentation develops to restore or maintain active acetone and $BuOH$ fermentation.

Glycerol by sugar fermentation in an alkaline medium. F. A. McDERMOTT. *U. S.* 1,551,997, Sept. 1. By the use of a yeast designated as "yeast No. 16" a more rapid glycerol production is attained than with other yeasts heretofore used.

Apparatus for making beer of low alcohol content. H. E. DECKEBACH. U. S. 1,551,979, Sept. 1. A closed fermenting vat is provided with temp.-regulating coils and is connected to a condenser for recovery of vaporized alc.

Yeast. L. J. HOWELLS. Brit. 230,110, March 3, 1924. Yeast growth is commenced in a small portion of the total wort to be used and the remainder is added at intervals. The amt. added during each successive period may be about 1.26 times that added during the next preceding period. The raw materials may be mashed in 2 portions to obtain 2 sep. worts, one having a high and the other a low ratio of fermentable carbohydrates to assimilable N; these 2 worts are then blended in suitable proportions to enable the yeast to assimilate the whole of the available N.

Yeast. J. WEBER. Brit. 230,098, March 1, 1924. In the malfuf. of yeast by the aeration process, a small quantity of $(\text{NH}_4)_2\text{SO}_4$ or other suitable NH_4 salt is added to the wort at the beginning of the fermentation to supply readily assimilable N for a preliminary rapid growth of the yeast. In the subsequent stages of the process, the N is supplied by the org. compds. present in the wort.

Yeast. MELLEMEURO-PARISK PATENT-FINANCIERINGS-SELSKAB AKTIESELSKAB. Brit. 230,049, Feb. 28, 1924. Nitrogenous yeast foods are obtained by treating animal wastes such as fish residues, fish or meat guano, dried blood, horn-meal or powd. leather, with steam while suspended in H_2O contg. lime or other basic compd. of an alkali or alk. earth metal. Brit. 230,050 specifies prepg. yeast by the aeration process, with use of a starting yeast which has been first treated, with moderate aeration, in an acid culture medium rich in nitrogenous substances, to invigorate the yeast without more than slight budding. The mixt. is then dild., more vigorously aerated, and a nutrient soln. such as may be prepd. from molasses is continually added as consumed by the yeast growth. Brit. 230,051 specifies the production of NH_4 lactate in a yeast-nutrient wort by adding $(\text{NH}_4)_2\text{SO}_4$ to a wort contg. Ca lactate (prepd. by lactic fermentation and addn. of lime).

17. PHARMACEUTICAL CHEMISTRY

W. O. EMERY

Tolu balsam from Java. L. VAN ITALLIE AND A. HARMSMA. *Pharm. Weekblad* **62**, 893-900(1925).—Examn. of Tolu balsam obtained from Java showed no essential difference between this and the balsam imported from South America. The soly. in various solvents was: CS_2 28.6, Et_2O 2.4, EtOH 61.6, insol. 7.4%. Detn. showed 0.2% vanillin, and the acid fraction consisted of cinnamic acid and BzOH in the proportions 1:4.5. In the Et_2O ext. the PhCH_2 esters of cinnamic acid and BzOH were present in the proportions 1:9. The resinous matter consisted largely of cinnamic acid derivs. from which the free acid was obtained in 40% yield after refluxing with alc. KOH .

A. W. DOX

Adaptation of the cyanogen iodide method to the titration of iodide and ferrous iron in sirup of ferrous iodide. I. M. KOLTHOFF. *Pharm. Weekblad* **62**, 910-14(1925).— KMnO_4 oxidizes both Fe^{++} and HI , and in the presence of HCN the I is converted into colorless CN . The latter may then be titrated with KI and $\text{Na}_2\text{S}_2\text{O}_3$. The difference between this titer and the KMnO_4 titer then represents Fe^{++} . By 2 successive titrations both Fe^{++} and HI may be detd. in the same sample. To the sample contg. about 0.15 g. FeI_2 add a mixt. of 10 cc. 25% H_3PO_4 (free from H_3PO_3), 5 cc. 10% KCN and 85 cc. H_2O , and titrate in a glass-stoppered flask with 0.1 N KMnO_4 until a faint rose color appears (a cc.). Add 5 cc. N KI and titrate with 0.1 N $\text{Na}_2\text{S}_2\text{O}_3$ and starch indicator (b cc.). I content = $b \times 12.69$ mg., and Fe^{++} content = $(a - b) \times 5.58$ mg.

A. W. DOX

Occurrence of berberine in *Chelidonium majus* L. J. GADAMER. *Apoth. Ztg.* **39**, 1569-70(1925); *J. Soc. Chem. Ind.* **44**, 262-3B. —The by-product obtained by Merck in the prepn. of chelidonine, and considered by him as impure sanguinarine-HCl, is berberine-HCl. Berberine pseudocyanide is converted by AcOH into the acetate. Berberine is to be regarded as a chelidonium alkaloid, identical with chelidoxanthine.

W. O. E.

Constituents of some Indian essential oils. XIII. Essential oil from a new species of *Andropogon* occurring in the Etawah District, U. P. J. L. SIMONSEN. *Indian Forest Records* **10**, 153-65(1924); cf. *C. A.* **18**, 1031. —The oil obtained by steam distn. of the flower heads of the grass in a yield of 0.4 to 0.5% was yellowish brown with a terpene-like odor. The following consts. were detd.: d_{40}^{30} 0.9094, n_D^{30} 1.4836, $[\alpha]_D^{30}$

25.7°, acid value 0.57, sapon. value 0.4, sapon. value after acetylation 74.32. The oil contained as essential ingredients *d*- Δ^4 -carene, *d*-cadinene, *d*-piperitol, d_{30}^{30} 0.9291, n_D^{30} 1.4794, $[\alpha]_D^{30}$ 3.2°, *d*-caryophyllene, and a sesquiterpene alcohol, d_{30}^{30} 0.9497, n_D^{30} 1.5000, $[\alpha]_D^{30}$ 8.5°. Among the hydrolytic products of the ester fraction were caproic, caprylic, and palmitic acids. Cf. following abstr. W. O. E.

Constituents of some Indian essential oils. XVII. Abietic acid from the resin of *Pinus longifolia* Roxb. M. G. RAO AND J. L. SIMONSEN. *Indian Forest Records* 11, 207-14 (1925) —The nature of the acid present is abietic, identical in all respects with the acid derived from *P. pulustris*. Both acids purified by Steele's method m. 168-9°, were crystallographically identical, differing only slightly in their rotatory power. New derivs. comprise a dihydrochloride, $C_{20}H_{32}O_2Cl_2$, m. 205°, a monohydrochloride, $C_{20}H_{32}O_2Cl$, m. 197°, a monohydroxy acid, $C_{20}H_{32}O_3$, m. 230°, and a dimol hydrochloride, $C_{40}H_{64}O_2Cl_2$ decomps. at about 310° Cf. preceding abstr. W. O. E.

Western Australian sandalwood oil. HORACE FINNEMORE. *Perfumery Essent. Oil Record* 16, 254-6 (1925) —The chief points of difference between this oil and that from East Indian sources are the following. The lower negative optical activity and the dextro-rotation of the residual oil after distg. off 20% from the original W. Australian oil. The lower % of alcohols, 76 and 78, against a minimum of 90%. The ease with which the alcs. decomposed when the oil was distd., even in an atm. of CO_2 at 12 mm. pressure. The small % of "santalenic" acid, 8%, as against 20% when oxidized with $KMnO_4$ by Chapman's process. Chemically, there is no evidence of any difference between the alcs. of Australian oil of good quality and those of Indian oil W. O. E.

Specific gravity of tinctures. F. WRALSCHKO. *Pharm. Presse* 30, 31 2, 59-60, 106-8, 116-9, 135, 142-5, 166-8, 177-9, 185-6 (1925) —A discussion of the theory and application, including tabulated data. W. O. E.

Liquid menthol. M. R. HUERRE. *Repert. pharm* 36, 193-5 (1925) —A com. product offered under the name of liquid menthol is believed to be a dementholated and deterpenated oil of peppermint W. O. E.

Silver arsenamine. IV. A. BINZ, H. BAUSCH AND E. URBSCHAT. *Z. angew. Chem.* 38, 740-3 (1925) —The addn. of PhN_2H_3 to a fresh soln. of Ag arsenamine (a) and a Ag salt in H_2O is followed by the evolution of N. If allowed to stand an hr. before such addn. no N is evolved. This latter behavior also holds true for com. (a). The union of arsenamine and $AgNO_3$ is not immediate, but requires on the contrary a definite time. The same is true likewise for arsenamine and $CuCl_2$. The compd. arising from the union of arsenamine and $AgNO_3$ behaves like a difficultly decomposable acid chloride toward Na_2CO_3 , which "acid chloride" in the presence of $NaHCO_3$ is pptd. as a pure light yellow addn.-product of arsenamine and $AgCl$, of the formula $HO(NH_2)C_6H_4AsAsClAgC_6H_4(NH_2)OH$. The corresponding acid, $HO(NH_2)C_6H_4As:OAsOHAgC_6H_4(NH_2)OH$, is obtained as a brown ppt. on treating a soln. of (a) with CO_2 , its Na salt, $NaO(H_2N)C_6H_4As:OAsONaAgC_6H_4(NH_2)ONa$, constitutes (a). The dihydrochloride (yellow ppt.), dinitrate (brown yellow) and sulfate (brown yellow) derivs. of the "acid chloride" were isolated and characterized. On treatment with I this compd. yields AgI in accordance with the equation. $RA_sAsAgClR + 8I + 6H_2O = 2RA_sO_3H_2 + AgI + 7HI + HCl$, in which R = the aminophenol radical. W. O. E.

The analysis of surgical dressing and suture materials. ALFREDO AND PAGNELLO. *Giorn. farm. chim.* 74, 153-8 (1925) —The Pharmacopoeias of the world show a deplorable lack of completeness and agreement on this subject. The Italian army medical service has developed adequate chem., bacteriol., microscopical and mech. tests. The crude immersion test for absorbent power was replaced by an exact one which gives lower results. The absorbent power is reduced in strongly twined fibers and is sometimes completely destroyed by sterilization. MARY JACOBSEN

Javanese oil of citronella. ÉTABLISSEMENTS A. CHIRIS. *Parfums de France* No. 30, 222 (Aug., 1925); cf. *C. A.* 18, 3252; 19, 378. —Oils of citronella with normal constns. which give a low yield of citronellal are presumably adulterated with tails from the rectification of oil of citronella in the com. manuf. of citronellal. They consist mainly of sesquiterpenes and tertiary sesquiterpene alcs. These alcs., when distd. in the oil, can be acetylated without excessive dehydration and are partly accounted for in the "total geraniol." Addn. of 10% of tail fractions to pure oil does not change the constns. sufficiently to indicate that the oil has been adulterated; but the residue on distn. is greatly increased, without its compn. being changed. Pure oil should not give more than 10% residue b. above 250° at atm. pressure. A. PAPINEAU-COUTURE

Determination of vanillin. L. AMORETTI. *Profumi italiani* 2, 251-4 (1924); *Chimie*

et industrie 14, 261.—A. recommends the Hanus method, based on formation of *m*-nitrobenzoylhydrazone. Benzoyl-*m*-nitrobenzoylhydrazine is stable enough to keep. It does not react with aldoses and ketoses, and can be used for detg. vanillin in vanillated sugar. The method is inapplicable in presence of numerous aliphatic and aromatic aldehydes, but can be used in presence of coumarin, BzOH or acetanilide. Vanillin-*m*-nitrobenzoylhydrazone forms yellow flakes, *m.* 207–9°. A. PAPINEAU-COUTURE

Production of antitoxins. G. RAMON. *Compt. rend.* 181, 157–9(1925).—Details for the prepn. of diphtheritic and tetanic antitoxins are given. L. W. RIGGS

Copper in nux vomica? F. G. HOBART. *Pharm. J.* 112, 670(1924).—Contrary to statements in standard works, no trace of Cu was found in nux vomica seeds. The greenish blue color noted upon the action of NH_4OH on mixts. contg. the tincture cannot be caused by the small quantities of Cu sometimes present as an impurity; it is caused by *caffeo-tannic acid*. S. WALDBOTT

Organic, protein and colloidal silver compounds. P. M. GIESY. *J. Am. Pharm. Assoc.* 14, 8–9(1925).—Principally a discussion and interpretation of the values found by Smith and Giesy (cf. following abstr.). L. E. WARREN

Silver-ion concentration studies of colloidal silver germicides. R. B. SMITH AND P. M. GIESY. *J. Am. Pharm. Assoc.* 14, 10–18(1925).—The potential measurements were made with a Leeds and Northrup potentiometer at room temp. between 20° and 30° but usually near 25°. The general method used was to make up 100 cc. of a soln. contg. sufficient of the compd. to be 0.1 *N* with respect to the Ag content and to titrate this with 0.1 *N* HI, KI, HCl or NaCl and to follow the titration by means of a Ag electrode in the soln. The details and calcs. are not abstracted. The materials studied were AgNO_3 , Ag_2O , Protargentum (protargin strong type), Solargentum (protargin mild type), collargol (collargol type) and a lab. prepn., colloidal AgI. Solargentum contains 11–14% of its Ag in a form more highly ionized than AgI in the presence of an excess of sol. iodide. Its p_{Ag} is 6.7–7.1. Collargol has an initial p_{Ag} of 6.5 and 10% of its Ag is more ionizable than AgI. The remainder of the Ag in these compds. is probably metallic. The ionizable Ag is probably combined with protein in some insol. or slightly ionized form. Protargentum has p_{Ag} of 2.1 to 2.4 and 8% of its Ag is more ionizable than AgI. It is probably a mixt. of colloidal Ag_2O and Ag protein compds. The p_{Ag} of 0.1 *N* AgNO_3 is 1.08 if calcd. on a basis of 81% ionization. From the titrations a p_{Ag} value of 7.95 for AgI was found. In the titration with KCl a p_{Ag} value of 4.4 was found for a satd. soln. of AgCl. The Ag_2O was titrated with 0.1 *N* HI and a p_{Ag} value of 2.85 found. The initial p_{Ag} of colloidal AgI was 12.2. L. E. W.

Notes on the standardization of blood coagulants. A. T. PERKINS AND W. M. BILLING. *J. Am. Pharm. Assoc.* 14, 19–21(1925).—The blood coagulants on the market are of 3 types: one contains a fibrin enzyme, thrombin; another derived from tissue contains cephalin and the third contains tissue fibrinogen. These 3 types differ greatly in their manner of action and the market prepn.s. vary in potency, purity and stability. No single method has been devised to standardize these 3 types, because of the great differences in their action. The thrombin prepn.s. may be injected intravenously (1) under ordinary conditions without causing intravascular clotting and death, but they will almost instantly clot shed blood. The cephalin prepn.s. while they have a strong coagulating effect on shed blood and recalcified citrated or oxalated plasma mixed with blood serum, will not cause intravascular clotting even though injected in large amts. The fibrinogen prepn.s. will cause almost instant death by intravascular clotting when injected intravenously even in small quantities and will greatly reduce the clotting time of recalcified, citrated blood or shed blood taken from the animal's heart, uncontaminated with tissue juices. Subcutaneous injections or oral administrations will greatly reduce clotting time of blood. A method has been devised which gives a measure of the coagulating power of the coagulant of drawn blood. Into a depression of a clear porcelain spot plate which has been kept at room temp. 1 standard Pt loop (1 mm., or about 1–100 cc.) of a physiol. salt soln. is introduced and a similar amt. of the coagulant to be tested is placed in an adjacent spot. One cc. of arterial heart blood is now withdrawn from the test animal, a starved rabbit, by means of a well-oiled syringe with an 18 gage 1½ in. needle. The puncture is made through the 5th intercostal space into the left ventricle. If by accident venous blood is obtained it is discarded. Half of the blood obtained is mixed with the salt soln. and the other half with the coagulant. The clotting time is detd. as the elapsed time between mixing the blood with the coagulant and the first appearance of a fibrin thread. The fibrin threads are demonstrated by drawing fine L-shaped glass rods through the blood at the rate of 5 or 6 times per min. until a visible fibrin thread is picked up. The normal clotting time of blood from various rabbits varies somewhat so that the criteria of valuation are the

percentages of reduction in time for blood from the same rabbit. With fibrinogen as the coagulant the % of reduction varied from 15% increase (in 1 duplicate test) to 84% decrease in 16 other tests in duplicate. Av. reduction is 64%. L. E. W.

The standard for assay of pituitary solution U. S. P. X. E. E. NELSON AND J. C. MUNCH. *J. Am. Pharm. Assoc.* **14**, 22-4(1925); cf. C. A. **19**, 3001.—Dried, defatted gland material was prepd. as follows: The glands were cut into small bits with scissors, placed in about 1500 cc. of dry acetone and allowed to stand overnight. The acetone was decanted off, the material placed on watch glasses and dried in vacuum desiccators over fused CaCl_2 at a temp. of 25° . The dry material was rubbed up in a small agate mortar until it passed through a no. 40 sieve. There was a small residue of connective tissue that did not grind up well and was discarded; this weighed 0.63 g. The powd. material was again placed in the vacuum desiccators and dried overnight. It was transferred to 2 extn. thimbles and extd. for 3 hrs. with dry acetone in Soxhlet extractors. The powder was spread on a large watch glass and dried in the vacuum desiccator over CaCl_2 . It has been preserved in a desiccator in a light-proof cupboard. The yield from 115 g. of fresh gland was 17.9 g. of powder. Solns. were made from dry samples by 3 independent workers. The solns. prepd. were compared by the isolated uterus method of assay and they were found to be of uniform strength. The method has been adopted for the U. S. P. X. L. E. WARREN

Chemical examination of the root of *Leptotaemia dissecta*. NELLIE WAKEMAN. *J. Am. Pharm. Assoc.* **14**, 29-32(1925).—The ground root was steam distd. and about 0.6% of volatile oil obtained. The consts. of the original oil were $d_{20} 0.936$ and $\alpha_D -4.16^\circ$. The same values for the cohobated oil were $d_{20} 0.917$ and $\alpha_D -1.90^\circ$. The oil is devoid of aldehydes and phenols but contains 20-30% of valeric acid ester of an unidentified alc. and about the same amt. of free alc. The EtOH ext. of the root after steam distill. contained valeric acid, MeOH and MeNH₂. L. E. WARREN

The volatile oil of *Mentha canadensis* L. R. E. KREMERS. *J. Am. Pharm. Assoc.* **14**, 32-5(1925).—From 1000 lb. of fresh herb 114.5 lb. of air-dried drug were obtained. The drug was steam distd. The total yield of volatile oil was 2.16%. The consts. of the primary oil (A) and of the cohobated oil (B) were detd. separately. They are for A and B, resp., $d_{20} 0.931, 0.937$; $n_D^{25} 1.4835, 1.4852$; $\alpha_D^{25} 18.75^\circ, 20.60^\circ$; pulegone 90.0, 95%; acid no. not detd., 5.6; ester no. 11.2, 11.2; percentage of ester, 4, 4; total alc. 9.6%, free alc. 6.5%. In addn. to the pulegone another ketone is present in the oil. This was not positively identified but its semicarbazone m. $138-40^\circ$. The lower-boiling fraction contains *l*-limonene. An alc. is present but it is not *l*-menthol. L. E. WARREN

Volatile constituents of Valencia orange juice. J. ALFRED HALL AND C. P. WILSON. *J. Am. Chem. Soc.* **47**, 2575-84(1925).—The volatile constituents of Valencia orange juice are: those very sol. in H_2O (H_2O , Me_2CO , AcH , HCO_2H); those less sol. in H_2O (*iso*-AmOH, $\text{PhCH}_2\text{CH}_2\text{OH}$, esters of HCO_2H , AcOH and $\text{C}_6\text{H}_{10}\text{O}_2$, and an olefin alc., $\text{C}_{10}\text{H}_{18}\text{O}$, $b_p 92-3^\circ$, $n_D^{20} 1.4650$, $d_{20}^{20} 0.8706$, $[\alpha]_D^{20} 23.67^\circ$). Geraniol and terpineol were indicated but not positively identified. C. J. WEST

Ultra-violet absorption spectra of the alkaloids of the tropeine group (CASTILLE)
3. Colloidal Bi (GUTHRIE, KAUTTER) 2.

Medicinal compounds. CHEMISCHE FABRIK VORM. SANDOZ. Brit. 230,432, March 10, 1924. Examples are given of the prepn. of ureides of hexahydrobenzoic acid, α -bromohexahydrobenzoic acid, hexahydrophenylacetic acid and α -bromohexahydrophenylacetic acid by treating the corresponding acid chloride with urea. α -Bromohexahydrophenylacetic acid chloride and amide are obtained by dropping Br into hexahydrophenylacetic acid chloride and treating the product with NH_3 . Ureides thus obtained and similar products have sedative and narcotic properties.

Medicinal products from yeast and methylene blue, etc. HACO-GES. AKT.-GES. Brit. 230,404, Nov. 30, 1923. Yeast is treated with methylene blue and NaBr is added; on filtering and washing the leuco compd. first formed is oxidized by the air and may be used as an antiseptic or food for animals. Iodides produce similar compds. Cf. C. A. **18**, 1551.

Albumin-dye compounds for medicinal use. HACO-GES. AKT.-GES. Brit. 230,329, Nov. 30, 1923. (Addition to Brit. 208,699, C. A. **18**, 1551.) Compds. are prepd. from yeast and dyes and these compds. are then treated with NaI or other iodide or bromide to prep. derivs. contg. I or Br, which have antiseptic and nutrient properties.

Leptinol. E. T. KREBS. U. S. 1,551,888, Sept. 1. An alc. ext. of *Leptotaenia*

dissecta is freed from gums and other undesirable constituents, *e. g.*, by treatment with NaOH or KOH soln. and the oils and resins present are saponified, *e. g.*, by the same treatment, to obtain a product which is adapted for medicinal use as an expectorant, antiseptic on wounds, etc.

Medicaments for treating burns, etc. F. K. THAYER. Brit. 230,089, Feb. 27, 1924. Picrates of local anesthetics such as *n*-butyl-*p*-aminobenzoate, ethyl-*p*-aminobenzoate, methyl-*m*-amino-*p*-hydroxybenzoic acid, diethylaminoethyl-*p*-aminobenzoate (procaine), and di-*n*-butylaminopropyl-*p*-aminobenzoate are used as antiseptics and local anesthetics for incorporation in ointments or other preps. for treating burns, etc. The picrates are made by reaction of picric acid with 3 mol. proportions of the local anesthetic, in H₂O, alc. or C₆H₆.

Acridylaminophenylarsinic acids. CHEMISCHE FABRIK AUF AKT. (VORM. S. SCHMIDT). Brit. 230,082, Feb. 29, 1924. Therapeutic acridylaminophenylarsinic acids are made by interaction of a 9-halogenacridine and an aminophenylarsinic acid.

Barbituric acids. F. BOEDECKER. Can. 253,554, Sept. 8, 1925. Hypnotic derivs. of barbituric acids are produced by substituting at least 1 of the H atoms of the methylene group of the acids by halogenyl contg. H in at least the β -position.

Tooth paste. P. H. BRADY. U. S. 1,551,638, Sept. 1. A principal ingredient for tooth pastes is prepd. by saponifying Soap Lake salts (from Soap Lake, Wash.) in soln. with oils such as coconut oil and peach kernel oil which combine with the excess of alk. compds. in the salts.

Dental cement. P. POETSCHKE. U. S. 1,552,341, Sept. 1. A dental cement powder is formed of calcined Zn silicate and CaF₂.

Nicotine. H. K. McCONNELL. U. S. 1,551,676, Sept. 1. Tobacco material is treated in 2 sep. chambers in the first of which the fresh material has its nicotine volatilized by being subjected to heated vapors from a preceding charge which is being dried in the second chamber.

18—ACIDS, ALKALIES, SALTS AND SUNDRIES

FRED C. ZEISBERG

Manufacture of hydrochloric acid from chlorine. WILHELM HIRSCHKIND. *Ind. Eng. Chem.* 17, 1071-3(1925).—The reaction: $\text{Cl}_2 + \text{H}_2\text{O} = 2\text{HCl} + \frac{1}{2} \text{O}_2$ has been studied. A history of the preceding attempts to utilize this reaction is given. To be commercially practicable a reducing agent such as C must be used to combine with the O liberated by the reaction. The utilization of this reaction in conjunction with the water-gas process is accordingly advocated. This latter reaction must be controlled so that it will proceed according to the equation: $2\text{Cl}_2 + \text{C} + 2\text{H}_2\text{O} = \text{CO}_2 + 4\text{HCl}$ (at about 600°). Under these conditions, the process as a whole will be independent of outside heat, and is the most economical one for HCl formation from steam, Cl and C. A min. quantity of C is used and the highest concn. of HCl is produced. Absence of combustible constituents in the gases leaving the reaction zone makes this process also the safest. Under the best conditions, the exit gas leaving the furnace at 900° contained 73.5% HCl and 19% CO₂, with a 90% Cl gas and a rate of 95 kg. per hr.; whereas 100% yield would require 76.5% HCl to be formed. J. H. P.

Sulfuric acid in technical hydrochloric acid. C. MAYR AND F. BLAM. *Z. angew. Chem.* 38, 589-91(1925).—The presence of small percentages H₂SO₄ in HCl prepd. by distn. of NaHSO₄ with NaCl is due to a pyrosulfate content of the first material; it forms pyrosulfuryl chloride and chlorosulfonic acid. Storage of the bisulfate in moist air tends to decrease the pyrosulfate content. Pyrosulfate in the presence of bisulfate can be detd. by heating a sample in a porcelain tube with pure PbO, collecting the water in CaCl₂ tubes and calcg. S₂O₇ from this detn. and the free acid titration.

Production of ferric sulfate and sulfuric acid from roaster gas. G. L. OLDRIGHT, H. E. KEYES AND F. S. WARTMAN. *Trans. Am. Inst. Mining Met. Eng.* No. 1489D, 1925 (Advance copy), 15 pp.—Lab. tests in the production of acid ferric sulfate from SO₂-air mixts. and FeSO₄ solns. have been confirmed by pilot plant runs in which gas from roasters was used to aerate 1 ton lots of soln. With a 4 ft. soln. column, acid up to 55 g. per l. was produced at the rate of over 5 g. per l. per hr. with an efficiency of 94-99%. Acid ferric sulfate has been successfully produced from leaching plant scrap iron solns., with aerators of the porous fabric type. The costs for acid of a strength up to 50 g. per l. based on the above runs should be from \$4 to \$10 per ton, for a plant producing 20 tons of 100% H₂SO₄ per 24 hrs. J. H. PELRY

The purification of phosphoric acid by crystallization. WM. H. ROSS, R. M. JONES AND C. B. DURGIN. *Ind. Eng. Chem.* 17, 1081-3(1925).—The use of a Cottrell precipitator, instead of a scrubbing tower method, for the recovery of acid fumes in the prepn. of phosphoric acid from phosphate rock by volatilization, enables the authors to adjust conditions so as to give an acid soln. of such concn. that the greater part of it crystallizes upon cooling to relatively pure orthophosphoric acid crystals. The phys. properties of anhyd. and hydrated crystals of phosphoric acid are compared. The hydrated crystals, $2\text{H}_3\text{PO}_4 \cdot \text{H}_2\text{O}$, are prepd. free from adsorbed moisture by adding the proper amt. of water to a weighed amt. of fused anhyd. acid and cooling below 100° , until it has a sp. gr. of 1.85. The soln. is then cooled below 40° , inoculated with a crystal of acid, allowed to stand until crystn. is complete, then centrifuged. The crystals are melted at 50° and water is added to bring to 1.85; the soln. is inoculated and this process repeated 2 or 3 times. The crystals may be dried by standing over P_2O_5 several weeks. Graphs showing the soly. as a function of the temp. and the % yield of crystals from supersatd. solns. of different concns. are included. J. H. P.

The synthesis of ammonia by the Casale and the Fauser processes. I. L. LA NATURE 31, 134-8(1925).—A description, with diagrams of the equipment. C. C. D.

Potassium salts in the southern Urals. L. V. ZUB. *MÜHLEN. Kali* 19, 234(1925).—A brief discussion. In general the KCl content of the raw moist salts as mined lies between 60 and 70%. WM. B. PLUMMER

Potentiometric indication for the technical production of hypochlorite bleach solutions. RUDOLF MÜLLER. *Z. Elektrochem.* 31, 323-31(1925).—The potential of a hypochlorite electrode depends largely on the H-ion concn. of the soln., when equiv. quantities ClO^- and Cl^- are present. After trying out several metals, C and magnetite as electrode material, also bimetallic electrodes, either plain or with one retarded electrode (surrounded with asbestos cord) the following arrangement was finally found to give the best results for the technical control of the satn. of NaOH by Cl_2 (the behavior of various electrode materials is given in curves). A long glass tube is sealed with a bend in a porous cell with a rubber ring or stopper. The tube is surrounded by a Pt electrode just above the stopper and another one just below inside the cell, the leads going through the interior of the tube, which is filled up with paraffin. The cell filling consists of a mixt. of CaOCl_2 and $\text{Ca}(\text{OH})_2$ with water; the electrode wires lead to a sensitive galvanometer with series resistance. The whole app. is put as one immersion electrode into the hypochlorite bath; during the satn. of the NaOH by Cl_2 the potential drops gradually, approx. equiv. satn. is reached for zero potential (cf. Ger. 897,053).

B. J. C. VAN DER HOEVEN

Preparation of bisulfite and metabisulfite. J. FERNEL. *Quim. e Industria* 2, 145(1925).— $\text{K}_2\text{S}_2\text{O}_5$ was obtained from KHCO_3 in almost quant. yield and with the theoretical SO_2 content by a process leading usually to KHSO_3 , when the temp. was raised toward the end of the reaction. Only 3.1% SO_2 was lost by 72 hrs. exposure to air in a very thin layer. The process (no details of which are given) may be workable on a large scale. MARY JACOBSEN

Present situation of the nitrogen industry in France. J. H. LUCAS. *Chimie et industrie* 14, 315-8(1925). A. PAPINEAU-COUTURE

Helium resources of Germany. KURT PETERS. *Naturwissenschaften* 13, 746-7(1925).—From 1 kg. monazite sand one l. He can be obtained by heating to 1000° ; it is suggested that the Th plants recover this as a by-product; the estd. yearly production is 500 cu. m. It should be practically free from Ne. B. J. C. VAN DER HOEVEN

Fuller's earth in 1924. JEFFERSON MIDDLETON. U. S. Geol. Survey, *Mineral Resources of U. S. 1924*, Part II, 7-9(preprint published Aug. 10, 1925). E. H.

Commercial utilization of corncobs. O. R. SWEENEY. Iowa State Coll. Eng. Expt. Sta., *Bull.* No. 73, 7-11(1924).—A compilation and review of preliminary lab. work extant on corncobs and their utilization, with special emphasis on unpublished work carried out under S.'s direction. Possibilities of making a plastic condensation product by treating the cobs with phenols are particularly promising. It is probable that oxalic acid could be produced com. either by fusion with caustic alkali or by oxidation with HNO_3 ; the latter method gives a high yield. In case of war, large quantities of Me_2CO could readily be obtained by destructive distn. of the cobs. Furfural and activated char can easily be produced commercially, if a market is found for them. Production of paper pulp, cardboard, linoleum, wood flour substitutes, and plaster board was also investigated. A bibliography of 128 references with brief abstracts is given. A. PAPINEAU-COUTURE

• Artificial resins and plastic substances (HOPPER) 26. Technical preparation of

colloidal $\text{Fe}(\text{OH})_3$ sol (STADNIKOV, GAVRILOV) 2. Combustion of natural gas in lime kilns (KERTÉSZ) 21. The heat produced in the formation of chloride of lime (NEU-ANN, MÜLLER) (NYDEGGER) 2.

Hydrocyanic acid. O. LIEBKNECHT and DEUTSCHE GOLD- UND SILBER-SCHIED-ANSTALT (VORM. ROESSLER). Brit. 230,346, Aug. 1, 1924. HCN for use in disinfecting, fumigating, etc., is absorbed and stored in activated C, silica gel or similar materials.

Nitric acid. C. W. CUNO. U. S. 1,552,117, Sept. 1. In HNO_3 manuf., a stream of O-enriched air is bubbled through a heated mixt. of nitrate and H_2SO_4 in order to prevent formation of red N peroxide fumes.

Nitric acid from ammonia. L. H. GREATHOUSE. Can. 248,516, Apr. 7, 1925. NH_3 is catalytically oxidized, the gaseous reaction product is subjected to regulated cooling while contact is maintained between the uncondensed and unabsorbed portion and the condensate, and the energy of expansion of the unabsorbed final gaseous residue is utilized for cooling, the operations being carried out at about 60 lb. pressure.

Apparatus for producing nitric acid. G. GIADACOWI. Brit. 230,180, Dec. 6, 1923. Connected app. is arranged for feeding nitrate and H_2SO_4 to a reaction chamber and the outlet pipe for residual NaHSO_4 is of such cross-section that the reaction is completely finished and all N oxides are expelled before the mass is discharged. The app. is especially intended for use in making HNO_3 for use in the chamber process of H_2SO_4 manuf.

Ammonia. B. F. HALVORSEN. Can. 251,537, July 7, 1925. O is added to a gas mixt. contg. H and HCN and the mixt. is passed over a catalyst at raised temp. to convert the HCN into NH_3 . Cf. C. A. 18, 2584.

Ammonia synthesis. F. W. DE JAHN. Can. 248,515, Apr. 7, 1925. The gases used in the synthesis of NH_3 are brought into contact with liquid NH_3 under a pressure substantially equal to that used in the synthesis.

Synthetic production of ammonia. F. W. DE JAHN. Can. 253,015, Aug. 25, 1925. In producing a N-H gas mixt. for NH_3 synthesis by treating a mixt. of M, H and CO gases with steam in the presence of a catalyst, any deficiency in N is supplied by adding to the gas mixt. prior to the completion of the reaction the product of the combustion of a portion of the gas with air.

Synthetic production of ammonia. E. BALLETT. Can. 253,014, Aug. 25, 1925. The synthesis of NH_3 is conducted at pressures below 100 atm. in the presence of an alk. earth catalyst.

Treatment of natural alkaline salts. A. LAMBERT. Can. 249,255, May 5, 1925. A 28° Bé. soln. of NaCl , Na_2CO_3 and Na_2SO_4 is treated with CO_2 to convert the carbonate to bicarbonate, the mother liquor with the suspended ppt. is discharged at 33° and the bicarbonate is sepd. therefrom and washed with a solvent of Na_2SO_4 .

Cyanides. NORSK HYDRO-ELEKTRISK KVAELSTOFAKTIESELSKAB. Brit. 230,423, March 8, 1924. HCN is absorbed from gases in a 47.7% NaOH soln. at a temp. of 40° or in other hot alkali soln. of such strength that on cooling cyanide crystals sep. The crystals may be dried in a current of gas (free from CO_2) first at a low and then at a higher temp.; or the crystals may be melted at a temp. above 35° to obtain a salt contg. little H_2O .

Sodium bicarbonate and ammonium chloride. W. GLUUD and B. LOPMANN. Can. 252,455, Aug. 11, 1925. NH_3 and CO_2 are caused to react on a soln. satd. with NH_4Cl , NaCl and NaHCO_3 and contg. the readily sol. Na salt of an acid which forms readily sol. NH_3 and Na salts, the NaHCO_3 is sepd., the liquid is satd. with NaCl and the deposited NH_4Cl sepd. therefrom.

Crystallizing aluminium sulfate out of solution. J. B. LAROE. Can. 252,661, Aug. 11, 1925. $\text{Al}_2(\text{SO}_4)_3$ soln. is subjected to a partial vacuum and caused to boil violently and a screen is placed above the evap. pan, against which the soln. is thrown, to catch the salt, the soln. being permitted to drop back.

Recovery of thiocyanates and thiosulfates. M. DARRIN. Can. 251,764, July 14, 1925. In recovering thiocyanate from a soln. contg. it, a thiosulfate and finely divided impurities, there is formed a gelatinous hydrate of the thiocyanate capable of entrapping the impurities, and it with the entrapped impurities is removed from the soln.

Aluminium and potassium nitrates. NORSK HYDRO-ELEKTRISK KVAELSTOFAKTIESELSKAB. Brit. 230,045, Feb. 27, 1924. Al and K in leucite or other minerals are converted into nitrates (e. g., by treatment with a liquor contg. HNO_3 and mixed nitrates from a later stage of the process) and the resulting mixed nitrates are sepd. by washing with HNO_3 of about 60% strength which leaves a pure Al nitrate.

Calcium carbonate. W. H. ALTON. U. S. 1,552,024, Sept. 1. Amorphous

artificial CaCO_3 is prepd. by mixing lime 20 g. with a 14–20 Bé. soln. of Na_2CO_3 , agitating and heating to not over 93° for about 3 hrs. and washing and drying the product.

Pulverulent copper sulfate. L. A. BUNDS. U. S. 1,551,867, Sept. 1. A readily sol. CuSO_4 mixed with talc or other inert substance and adapted for prepg. Bordeaux mixt. is prepd. by grinding the inert substance to a finer mesh than the CuSO_4 and then blowing the substances together through a tube to effect their admixture.

Precipitation of insoluble sulfo salts. N. E. WILSON. Can. 262,563, Aug. 11, 1925. Sb_2S_5 is prepd. by treating a solid sulfantimonate with H_2SO_4 .

Sulfuryl chloride. R. H. MCKEE and C. M. SALLS. Can. 251,586, July 14, 1925. Cl and SO_2 are passed into SO_2Cl_2 and an inert diluent contg. an active C in suspension at a constant temp. • Cf. C. A. 19, 1476.

Carbon monoxide and hydrogen. A. A. L. J. DAMIENS. Brit. 230,106, March 3, 1924. CO is absorbed from industrial gases (e. g., water gas from which the H and CO are desired separately) by use of a countercurrent of a suspension of a cuprous compd. such as the oxide, sulfate or chloride in H_2SO_4 . Heating and treatment with H_2O serve to liberate the absorbed gas and regenerate the absorbents. The gases treated must be free from C_2H_2 and C_2H_4 and preferably should be free from O.

Hydrogen. SOC. L'AIR LIQUIDE, SOC. ANON. POUR L'ETUDE ET L'EXPLOITATION DES PROCÉDÉS G. CLAUDE. Brit. 230,413, March 8, 1924. C_2H_4 is used as a solvent for the removal of C_2H_2 and some other impurities, in recovery of H from gaseous mixts by partial liquefaction and rectification.

Hydrogen. F. W. DE JAHN. Can. 253,481, Sept. 8, 1925. A reaction is produced between water vapor and the lower oxides of Hg in the presence or absence of Hg. The gas is sepd. from the resultant higher oxides of Hg by cooling and the latter are regenerated for further use by heating.

• **Apparatus for producing hydrogen by the "metal-steam" process.** SOC. L'OXHYDRIQUE FRANÇAISE. Brit. 230,046, Feb. 29, 1924.

Metallic oxide gel. W. A. PATRICK. Can. 251,294, June 30, 1925. A mixt. is made with vigorous stirring of solns. of a sol. salt of the acid of the metal oxide and an acid, in such proportions as to give in the mixt. a concn. of H-ions of 0.1 to 0.5 mols. per l., the mixt. is allowed to set to hydrogel, is broken up, washed and dried.

Recovery of metals from silicates. F. M. McCLENAHAN. Can. 253,437, Sept. 8, 1925. In recovering metals from silicates the latter are decomposed with a fluoride of NH_3 to ppt. in intimate mixt. the fluorides of Al and NH_3 and steam at about 300° is passed through the ppt. to form hydrated oxide of Al.

Purifying sulfur. C. MARX. U. S. 1,552,217, Sept. 1. S to be purified is heated under greatly diminished pressure (preferably a vacuum of about 28 in. or lower) and the vapors are collected in condensing chambers.

Apparatus for burning sulfur. L. F. POLLAIN. Brit. 230,441, March 6, 1924. Formation of SO_2 is promoted by supplying auxiliary heated air and by superheating the products of combustion.

Purifying acetylene and other gases. A. HERMANN. U. S. 1,551,878, Sept. 1. A gas-purifying material is prepd. by mixing basic hypochlorite compds. such as those of Ca and Mg (practically free from chloride) with an agglutinant, e. g., plaster of Paris or portland cement, and H_2O , and allowing the mixt. to set.

Regeneration of technical adsorbents. NAAMLooZE VENNOOTSCHAP ALGEMEENE NORIT MAATSCHAPPIJ AMSTERDAM. Dutch 13,208, June 15, 1925. Adsorptive carbon, kieselsguhr, Florida earth and other adsorbents are regenerated by heating them, with or without previous extn., to a moderate temp. (400 – 600° for carbon, 200 – 250° for Florida earth) such that by subsequent extn. of the substance with acids or alkalies the decomposed org. impurities can be removed.

Preparation and regeneration of activated carbon. NAAMLooZE VENNOOTSCHAP ALGEMEENE NORIT MAATSCHAPPIJ AMSTERDAM. Dutch 13,161, June 15, 1925. The granulated carbon, kept in suspension either by the activating gas stream or by a sep. stirring mechanism, is more thoroughly and evenly attacked. • Previous treatment with chemicals and activation by more than one gas at different temps. may be advantageous; for air 300 – 500° , for steam 700 – 1000° , for CO_2 1200° is recommended. • Regeneration is accomplished in a similar way by selective combustion of the secondary carbon with steam at 500 – 700° . Cf. C. A. 19, 2867.

Vertical cylindrical retort for making decolorizing carbon and activating it. J. N. A. SAUER. Brit. 230,293, April 5, 1924.

Impregnating diatomaceous earth, etc., with sulfur. W. H. KOBBE. U. S. 1,551,573, Sept. 1. Diatomaceous earth or other cellular material is impregnated with S (by melting the latter) in order to obtain a product which is adapted for making vats,

sinks, acid tanks or elec. or heat insulation. U. S. 1,551,574 specifies sandstone impregnated with S.

Absorbent and catalytic oxides. W. A. PATRICK. Can. 250,593, June 9, 1925. A highly absorbent and catalytic oxide of a metal whose hydroxide is substantially insol. in water is prepd. by mixing with thorough stirring a concd. soln. of a sol. salt of the metal and a soln. of a sol. alkali of such concn. and amt. that the resulting mixt. is faintly alk., the mixt. being maintained at a temp. not exceeding about 10° and washing and drying the gelatinous ppt. formed.

Aldehyde condensation products. C. J. HERRLY. Can. 252,344, Aug. 4, 1925. The acidity of aldehyde is neutralized, 0.01–0.10% of caustic alkali is added and a temp. above 20° is maintained to produce a condensation product.

Liberation of asbestos fiber. S. H. DOLBEAR. Can. 250,779, June 16, 1925. Impurities are sepd. from masses of asbestos fiber by wetting the mass, causing the fibers to mat together in removing the water and screening to remove the impurities and gang.

Adhesives, etc. W. GUIARD. Brit. 230,087, Feb. 27, 1924. An adhesive for securing disks of celluloid used as letter seals, etc., may comprise a soln. of celluloid in acetone with an addn. of oxalic acid. Other solvents and thickeners may be added.

Metal polish. M. LEVIN. U. S. 1,551,673, Sept. 1. Dil. alc. is mixed with abrasive particles coated with Ca and NH₄ soaps.

19 · GLASS, CLAY PRODUCTS, REFRACTORIES AND ENAMELED METALS

G. E. BARTON, C. H. KERR

The effect of composition on the viscosity of glass. III. Some four-component systems. S. ENGLISH. *J. Soc. Glass Tech.* 9, No. 34, 83–98 (1925).—Using the same app. described previously (*C. A.* 17, 3584; 19, 385), E. finds that the effect of the O replacement by MgO smooths out the viscosity curves of glass. Substitution of Al₂O₃ for CaO in mol. amt. causes increased viscosity at high temps. and lower viscosity at lower temps. The working range is thereby increased. H. F. K.

Deterioration of a flint glass. P. NICOLARDOT. *Rev. optique* 3, 497 (1924); *J. Soc. Glass Tech.* 9, 18.—The surface of a plano-convex lens, one member of an objective, which had been kept in a phys. lab. exhibited small, mirror like specks of metallic luster, very similar in appearance to a very thin deposit of Pb sulfide. The surface of the lens that was attached to the other member had not suffered any deterioration. Half an hour's treatment of the glass, which contained 44% PbO, in an oxidizing solution converted the lustrous specks into a thin, white veil of Pb sulfate, while exposure to H₂S again produced the mirror-like deposit which, on oxidation, yielded the white sulfate. The specks which had been produced on the lens surface as the result of exposure to the atm. of a phys. lab. were undoubtedly due to the formation of Pb sulfide. H. G.

The manufacture of plate glass at the Chantierine works. I. L. *La nature* 53, ii, 49–53 (1925).—An illustrated description of the latest methods of plate-glass manuf. from the raw materials to the finished product. C. C. DAVIS

The development of the art of glass melting. M. VON ROHR. *Naturwissenschaften* 13, 619–22 (1925); cf. *C. A.* 18, 3690.—Historical. B. J. C. VAN DER HOEVEN

Magnesia as a ceramic raw material. A. BERGE. *Kali* 19, 285–8 (1925).—Applications are discussed and some expts. reported. In MgO cements increasing the MgCl₂ retards setting; with (mol. ratio MgO/MgCl₂·6H₂O) a 1/1 mixt. the setting time was 21 days, with 2/1 8 days, with 4/1 3 days. Cements were prepd. by using 2 parts by wt. of MgO and 1 part of each of various chlorides. With AlCl₃, ZnCl₂, HgCl₂, MnCl₂ and CuCl₂ the reaction was similar to that with MgCl₂ as regards rate of setting and character of product, save that in the last 2 cases the products were, resp., brown and blue. With AlCl₃ or FeCl₃ the setting was almost instantaneous, while no reaction occurred with PbCl₂. Samples of MgO prepd. from the oxychloride or from magnesite at 600°, 1200°, or 1600° all reacted the same with MgCl₂ within the limits of observation. Cements prepd. from MgO with AlCl₃ or FeCl₃ were least resistant to the action of H₂O, those from CuCl₂, MnCl₂, or SnCl₂ were the most resistant. In general cements with more than 1 mol. chloride to 4 mols. MgO were not resistant to H₂O. WM. B. PLUMMER

Action of fluxes on fine-ceramic raw materials. K. G. VERSHOFEN. *Keramos* 3, 451 (1924).—The effect of strongly basic Ca, Mg and Na compds., and also of sol.

fluorides, upon the 4 chief raw materials—clay, kaolin, feldspar and quartz—at temps. up to 1000° , was studied. No action was observed with the first two, and feldspar also was practically indifferent. Quartz was the most affected, the action being dependent upon the degree of fineness of the particles. B. C. A.

A treatise on Missouri clays. M. H. THORNBERRY. *School of Mines and Metallurgy, Univ. of Mo., Bulletin* 8, 9-69 (1925).—The clays of Mo. are described in detail with analyses and phys. tests. C. H. KERR

Determination of grit in clays. G. M. DARBY. *Chem. Met. Eng.* 32, 688-90 (1925).—Detns. of grit in paper clays were made by elutriation, flotation, centrifuging and wet screening. The samples tested were Georgia clay, English clay, Penna. washed clay and talc. Wet screening is satisfactory for grit coarser than 325 mesh. Other methods must be used for finer material. The Nobel elutriation app. takes too long but is accurate. The flotation method is good when combined with wet screening. The A. D. Little flotation method does not give consistent results. The centrifugal method gives comparative but not quant. results. R. J. MONTGOMERY

Sedimentation as a means of purifying clay. S. R. HIND. *Gas J.* (Suppl. July 9, 1924), 24; *Trans. Ceram. Soc.* 23, 234 (1924).—The suitability of a clay for purification by sedimentation depends on the concn. of the bulk of the impurities in the coarsest fractions. Flint clays are not suitable for treatment, and preliminary weathering is necessary with shales. A small proportion of deflocculant (Na carbonate or silicate, etc.) is added during or after deflocculation to destroy the gelatinous nature of the clay and to economize in water. The various phenomena of deflocculation, coagulation, and settling are discussed, and certain theoretical conceptions enunciated. The clay grains possess a selective chem. power depending on their surface area. Na silicate appears to stabilize clay suspensions by coating the particles with gelatinous silicic acid, thereby masking the normal reactions of the clay. Normal (coagulated and gelatinous) clay slips and plastic clay masses contain water in a "fixed" or non-fluid condition, and this is intimately bound up with plasticity. The clay appears to act as a semi-permeable membrane around this water. Hydrostatic pressure alone has a great effect in de-watering clay. With a North Staffordshire fireclay sedimentation reduced the percentage of Fe but had little effect on the titania, alkalis and alk. earths, gave a fine-grained product, and increased the refractoriness and contraction on drying and firing. When the clay was removed from the slip by electroosmosis no further practical improvement could be detected. With Karlsbad kaolin the clay forming the purified slip fed to the osmosis machine had the same refractoriness and similar analysis to the material discharged from the machine. Various methods of treating clay depending on its nature and other conditions are summarized. B. C. A.

Corrosion of firebricks, silica bricks, and magnesite bricks by blast-furnace and open-hearth furnace slags. J. PRELLER AND V. KORBER. *Chem. Listy* 19, 48-51 (1925); cf. C. A. 19, 2869.—The basic slags of the open-hearth furnace have much less corroding action on magnesite bricks than on firebricks or silica bricks, and the intensity of this action is reduced the smaller the periclase crystals, the denser the brick, the smaller its SiO_2 content, and the more slowly it is cooled. SiO_2 favors the formation of olivine, and this reduces the softening point of the brick. B. C. A.

Influence of texture on the transmission of heat through firebricks. A. T. GREEN. *Gas J.* (Suppl. July 9, 1924) 31-6; *Trans. Ceram. Soc.* 23, 253.—Bricks were made from a Stourbridge fireclay with varying percentages (up to 50) of grog prepd. from the same clay, the grog being carefully graded. The true and apparent sp. gr., porosity, and the crushing strength were detd. The higher the temp. of kilning the higher is the thermal cond. Diffusivity measurements at lower temps. indicate that with increasing porosity there is decreasing thermal cond. The material with a high grog content has at the higher temps. a higher diffusivity and thermal cond. than the low-grog material, while the reverse is the case below 1000° . At high temps. the transmission of heat by convection and not by the pore spaces increases, so that the cond. of high-grog bricks having the continuity of the solid material interrupted by grog increases more rapidly than that of low-grog bricks. B. C. A.

Thermal conductivity and some other properties of two commercial heat-insulating bricks used in kiln construction. A. T. GREEN. *Gas J.* (Suppl. July 9, 1924) 29-31; *Trans. Ceram. Soc.* 23, 271.—Two batches of bricks were examd., one prepd. from Irish kieselguhr with the addn. of 15% of cork and sawdust and the other from Algerian kieselguhr to which 15% of sawdust and 10% of clay were added. The refractoriness of both was low, and the first batch began to shrink appreciably at 900° , the shrinkage being accompanied by a great increase in the thermal cond. For high-temp. insulation purposes the kieselguhr should be purified so that the brick contains at least 92% of silica.

The mean thermal cond. ranged from about 0.00025 for the range 511–290°, to 0.00031 for the range 840–360°. A brick with a porosity of 70–80% or an apparent sp. gr. of 0.55–0.7 will in general be a satisfactory insulator. B. C. A.

Effect of repeated burning on the structure and properties of lime-bonded silica bricks. W. HUGGINS AND W. J. REES. *Gas J.* (Suppl. July 9, 1924) 24–7.—Silica brick made from Sheffield ganister with a lime bond were tested (after burning repeatedly (up to 11 burns) in a works kiln. The greater part of the inversion took place in the first burn, but there was a steady decrease in the proportion of quartz and in the porosity down to the seventh burn. There was very little change in vol. after the first burn. The crushing strength increased up to the seventh burn, the toughness increased gradually after the sixth burn, and the transverse strength increased steadily up to the fifth burn. The chem. analysis was not affected by repeated firing. The percentage of tridymite increased with the no. of burns, and after the eleventh burn most of the silica had inverted to tridymite. B. C. A.

Storage of silica refractories. W. J. REES. *Gas J.* (Suppl. July 9, 1924) 47–8.—Batches of silica bricks, one of coarse and the other of fine texture, were exposed to the weather for 6 months, and their crushing strengths (after air drying) compared with those of bricks of the same batch stored both under the same temp. conditions, but protected from the weather, and also in a warmed storeroom. The crushing strength of the bricks was not affected by storing in a warm room, but was considerably reduced in the other 2 cases, the bricks unprotected from the weather having the lowest crushing strength. The resistance to spalling was decreased by weathering, but no appreciable change in chem. compn. was detected. Briquets were made from Totley ganister with a lime bond and fired at 1300°, 1400° and 1500°. The lime, alkalies and alumina dissolved out by boiling these briquets with distd. water for 6 hrs., by soaking for 1 week in cold water, and by spraying daily with water for 40 days, and their crushing strengths were detd. Definite indications were found that the loss in strength of silica bricks on exposure to weather was due partly to a slight degradation of the bond by hydration and soln. in water, as well as to the phys. effect of frequent wetting and drying. The bricks burned at the higher temps. were more resistant to attack by water and the loss in strength was most marked in the test where the briquets were sprayed daily with water. B. C. A.

Relation between ordinary refractoriness, under-load refractoriness, and composition, physical and chemical, of refractory material. I. A. J. DALE. *Gas J.* (Suppl. July 9, 1924) 18–23.—Briquets contg. 0, 20, 40 and 60% of grog were molded and fired at cones 13–14. The ultimate chem. compn. and calcd. rational analysis, relative grain size compn. of the raw clays expressed as surface factors, porosity, apparent sp. gr. true sp. gr., contractions on drying and firing, refractoriness and behavior under load at high temps. were detd. It was found that the temp. at which subsidence commenced under load is independent of the grog content, that with the refractories examd. there is a variable range of temp. between the commencement of under-load subsidence and the point of complete failure, and that with one exception the temp. at which complete breakdown occurred under load is lower with the brick contg. grog than with the straight clays. The breakdown under load may occur as a straight subsidence with no bulging of the test piece and due to an abs. vol. contraction, a subsidence with bulging side of the specimen accompanied by vertical planes of cleavage, or subsidence accompanied by a diagonal plane of cleavage, some softening having occurred. A standard test piece was prepd. such that it gave a regular thermal expansion up to 1400° and its dimensions remained const. on heating for 3 hrs. at this temp. The contraction of other refractory materials under load at high temp. was compared with the expansion curve of the standard test-piece. The results recorded indicated that the greater the proportion of the grog the more rapid and the greater was the subsidence. B. C. A.

Note on refractoriness under load. J. W. MELLOR. *Gas J.* (Suppl. July 9, 1924) 23.—The difficulty in endeavoring to find a relation between the phys. and chem. character of a firebrick and its squatting temp. under load is due partly to the difficulty in distinguishing the 2 distinct types of fracture, the one due to a mech. breaking down of the brick and the other due to gradual subsidence under load. B. C. A.

Some causes of the variation in the sizes of refractories—bricks and blocks. I. J. W. MELLOR. *Gas J.* (Suppl. July 9, 1924) 27–8.—Different clays mature at different temps. on firing. The best temp. for maturing a firebrick is that at which the contraction-temp. curve shows that any further rise of temp. produces insignificant change in vol. up to the highest temp. at which the brick is likely to be used. If this temp. has not been reached in the kiln there will be greater variations in the size of the brick due to the inequality of heating throughout the kiln, than when this temp. has been

attained. If the bricks are set too closely in the kiln the inequalities of heating are emphasized. B. C. A.

Changes in the micro-structure of porcelain, and some of its physical properties, during the firing process in the tunnel kiln. E. KEMPCKE. *Keramos* 3, 551-7 (1924).—The course of porcelain formation above a temp. of 1000°, the interaction of the raw materials with each other, and the changes in the structure of porcelain were investigated microscopically. Certain phys. properties also were detd. Samples were taken from a tunnel kiln, after having been fired for periods varying from 22½ to 31¼ hrs. at temps. varying from 1050° to 1420° in intervals of 25° to 60°. The phys. tests included the detn. of the color and hardness of body and glaze and of the fracture, the porosity and the true and apparent sp. gr. For the microscopical tests thin sections, cut perpendicularly through body and glaze, were prepd. The products obtained between 1050° and 1160° were "dry" in appearance and non-translucent, like earthenware. Evidence of sintering appeared at 1180°, and at 1230° the ware was almost porcelainic in character. The phys. tests shed further light on this transitional development. Porcelain formation continued, with increasing soln. of the quartz and crystal formation, until it reached its max. at 1420° B. C. A.

- Refractories for gas retorts. (EMERY) 21. Bibliography of clay deposits (RIES)
8. The structure of glass (SELJAKOW, *et al.*) 2.

Slag in glass manufacture. C. E. PARSONS and S. PEACOCK. U. S. 1,551,616, Sept. 1. In order to utilize for glass manuf. a basic blast furnace slag contg. combined S, Al, Ca and Mg, the Ca sulfide present is converted into hydrosulfide by treating the slag with steam under a pressure above 150 lbs. per sq. in. The sol. Ca hydrosulfide is sepd. and the residue is treated with NaOH to form a sol. Na aluminate with the Al present, the aluminate is sepd. and the desired Ca and Mg silicate residue recovered.

Glass-annealing leer. EMPIRE MACHINE CO. Brit. 230,261, March 4, 1924.

Refractory bricks, etc. F. W. COBB. Brit. 230,248, Feb. 22, 1924. Firebricks, crucibles of other refractory articles are molded from fireclay 1 and ground pebble (obtained from sand beds and comprising quartz, limestone, volcanic ash and sandstone) 2 parts. The ground pebble may be partially substituted by ground tessara.

Refractory mass. G. KALLEN. Can. 251,394, July 7, 1925. A refractory mass consists of pulverized crude Zr ore, water glass, pulverized dolomite and feldspar.

Refractory cement. J. W. MARDEN and H. K. RICHARDSON. Can. 249,647, May 12, 1925. Finely divided thoria is mixed with finely divided cryolite.

Neutral cement. W. F. ROCHOW. Can. 250,556, June 9, 1925. A refractory compn. contains powd. Al_2O_3 and powd. Na_2SiO_3 preferably mixed with dextrin.

Joining parts of electric insulators with a slip and gum mixture. PORCELAIN-FABRIKEN NORDEN AKTIESELSKABET. Brit. 230,445, March 5, 1924.

20—CEMENT AND OTHER BUILDING MATERIALS

J. C. WITT

Variable cement tests. WM. MUESER. *Eng. News-Rec* 95, 154 (1925).—Discrepancies in the results of examn. of concrete materials carried out in different labs are cited and commented on, and it is suggested that there is widespread doubt as to the reliability of cement testing.

R. E. THOMPSON

Accelerated sand tests with alumina cement. N. W. DOUGHERTY. *Eng. News-Rec.* 95, 113 (1925).—Parallel tests of sand for concrete using 7- and 28-day Port. cement and 24-hr. alumina cement methods gave comparable results except for compressive strength of limestone screening, which was low by the latter method. Previous expts. have shown that limestone screening with Port. cement gives unusually high tensile and compressive strength. Cf. preceding abstr.

R. E. THOMPSON

Cement. *Proc. Am. Soc. Testing Materials* (preprint) No. 27 (June, 1925).—Committee C-1 has prepd. a manual of cement testing intended to supplement the physical tests and to recommend methods satisfactory and conducive to good uniformity. The manual treats of sampling, detn. of fineness, mixing cement pastes and mortars, normal consistency, detn. of soundness, detn. of time of set, tension tests, training of cement testers and cement tests for research purposes.

J. C. WITT

Notes on laitance. R. M. MILLER. *Proc. Am. Concrete Inst.* 21, 68-84 (1925).—Precautions for holding laitance to the min. include the use of clean aggregate; fresh

water free from dirt, earth or sewage; and a mix of a relative consistency of 1:10 to 1:15, the slump test being used to keep the consistency uniform. J. C. WITT

Shall anything be added to portland cement? M. TOCH. *Proc. Am. Concrete Inst.* 21, 134-47(1925).—T. states that there are many good materials on the market to be used for coloring and waterproofing cement, and for protecting concrete against acid and alk. conditions which normally destroy it. J. C. WITT

Coefficient-of-expansion tests on gunite. M. O. FULLER. *Proc. Am. Concrete Inst.* 21, 180-1(1925).—The coeff. of expansion per ° F. on 5 samples of gunite (max. temps. 970° to 1234°) is from 0.00000641 to 0.00000654. J. C. WITT

Report on tests made to determine the temperatures in reinforced-concrete chimney shells. E. A. DOCKSTADER. *Proc. Am. Concrete Inst.* 21, 204-15(1925). J. C. WITT

Inundation as a practical aid to uniform concrete. A. A. LEVISON. *Proc. Am. Concrete Inst.* 21, 216-31(1925).—A method for the correct vol. measurement of concrete aggregates, regardless of the moisture content. J. C. WITT

Reports of committees. *Proc. Am. Concrete Inst.* 21, 266-605(1925).—C-3—treatment of concrete surfaces; C-5—measurement of and tests of concrete; E-1—reinforced-concrete building design and specifications; E-4—fire resistance of concrete (a report of tests at the Pittsburgh labs. of the Bur. of Standards and the Underwriters Labs., Chicago, together with a bibliography of the fire resistance of concrete from 1877 to 1924. The fire resistance of concrete depends to a great extent on the kind of aggregates used. Details of the design of columns, girders and beams, and slabs, in relation to the fire resistance, are discussed); E-5—aggregates; E-6—destructive agents and protective treatments (the committee examd. a no. of structures which had been exposed to climatic conditions from 9 to 20 years, and were in all conditions of preservation—from practically perfect to those requiring extensive repairs. The relation of porosity to the durability of concrete is of prime importance, and the damage already done and that possible in the future is in proportion to the freedom with which water enters or passes through concrete. Porous concrete in the structures studied resulted from (1) excess of mixing water, (2) deficiency in cement, (3) dirt or excess of fine materials in the aggregate, or (4) segregation of materials in handling or placing the freshly mixed concrete. Impervious and durable concrete can be produced by requiring clean aggregates of durable minerals, a mixt. of a fair degree of richness, the use of a puddling consistency, and care in placing and curing); E-8—expansion joints in concrete construction; G-4—nomenclature; J-1—Am. Concrete Inst. representation on the joint committee on concrete and reinforced concrete (the complete report of the joint committee is given); P-1—standard building units; P-7—pipe, drain tile and conduit; S-6—concrete roads and pavements. J. C. WITT

Deterioration of structures in sea water. ANON. *5th (interim) Rept. of the Comm. of the Inst. of Civil Eng.* 65 pp.(1925).—The report covers the comparative corrosion of steel at Colombo, Halifax, Plymouth and Auckland; investigations to protect timber against *Teredo*; examn. of raft and test pieces at Plymouth; creosoting and impregnation of timbers with poisons; painting of steel plates; arrangements made to expose the paint specimens to the action of sea water and the atm. at Southampton; the salinity of the water in the Hamoaze; certain defects noticed in admiralty reinforced concrete structures; arrangements made for the exposure of certain blocks of poisoned timber at Colombo; condition of specimens of timber exposed to the action of the sea at Leith Docks. There are also abstracts of the reports on a no. of other investigations. J. C. WITT

Suggests one-day strength test for concrete aggregate. S. B. SLACK AND J. E. BOYD. *Eng. News-Rec.* 94, 1014-5(1925).—Results of expts. employing alumina cement and 1-day test period for strength and compression tests of concrete aggregates are given which indicate that the 24-hr. test is feasible and gives results comparable with present 28-day test with Port. cement. R. E. THOMPSON

Frozen concrete due to undesirable material. W. H. WHEELER. *Eng. News-Rec.* 95, 232(1925).—Brief discussion of failure of Gem Lake Dam in which the opinion is expressed that dense concrete equal to 1:2:4 mix in richness, made with clean aggregates which have water absorption of less than 1 lb. per cu. ft., will not be disintegrated by freezing and thawing. R. E. THOMPSON

Fundamental factors in concrete quality control. R. B. YOUNG. *Eng. News-Rec.* 94, 940-2(1925).—The scientific control of concrete is discussed and the necessity of the same emphasized. Abrams' water-cement ratio method is very reliable, but the fineness modulus and calcs. therefrom are of value only in detg. the most economic mix. The method favored is that of proportioning by workability after setting the

sand-gravel ratio by consideration of conditions, and detg. the water-cement ratio experimentally. Measurement of materials, mixing, placing and curing are stated to be of equal importance to detg. mixt., and it is pointed out that ordinary volumetric methods of measurement are very inexact, variations of 15 or 20% being common.

Cement linings for mine shafts. ERWIN ENGERT. *Braunkohle* 24, 475-84, 519-24 556-62(1925).—The use of ordinary and special quick-setting cements in driving shafts through wet strata is discussed in detail. B. E. THOMPSON
WM. B. PLUMMER

Combustion of natural gas [in cement kilns] (KERTÉSZ) 21. Bituminous emulsions [for road-making] (Brit. pat. 230,177) 22.

Bituminous concrete. M. LEVY. U. S. 1,552,403, Sept. 1. Acid-resisting tanks, etc., are made from a mixt. of gilsonite 100, an acid-resisting powder not coarser than about 600-mesh per cm.² 250-375, washed river sand of 4-100 meshes per cm.² 250-500 and acid-resisting broken stone of approx. diam. of 3-15 mm. 250-500 parts.

Artificial stone or marble. J. J. BURKE. U. S. 1,552,270, Sept. 1. Waterproof cement is mixed with sand and with a soln. formed of H₂O, Na silicate and H₃BO₃ and the surface of the product is moistened at intervals while curing.

Cement clinker. F. KRUPP GRUSONWERK AKT.-GES. Brit. 230,424, March 10, 1924. Cement clinker from a rotary kiln is cooled and hydrated by circulating a current of air and steam through the cooler and an evaporator or steam generator.

Heat-insulating material. J. J. BERGSMAN. U. S. 1,552,201, Sept. 1. A material adapted for coating wood or metals or for other use in building construction is prepd. by mixing pulverized bark of the djatti tree with a binding material such as Port. cement and infusorial earth.

Building blocks, etc., from slag and other materials. W. H. CRUME. U. S. 1,552,051, Sept. 1. A strong granular material such as slag is mixed with finely divided diatomaceous earth, hydrated lime and H₂O, molded and treated with live steam under high pressure in closed retorts.

Seasoning wood. H. MURMANN AND SPIRITUS-PRESSHEFE U. CHEMISCHE FABRIKEN HAMBURGER KUFFNER AKT.-GES. Brit. 230,044, Feb. 27, 1924. Wood is treated in closed vessels with NH₃ and steam, simultaneously, at a temp. not above 140°.

21—FUELS, GAS, TAR AND COKE

A. C. FIELDNER

Recent developments in fuel technology. R. WIGGINTON. *Fuel in Science & Practice* 4, 275, 325-7(1925); cf. C. A. 19, 568.—Short reviews in abstract form.

Personal observations on fuel research in Europe. A. C. FIELDNER. *Ind. Eng. Chem.* 17, 1046-50(1925). C. C. DAVIS
E. J. C.

Smokeless fuel. The present position and future possibilities. C. H. LANDER. *Colliery Guardian* 130, 145-6(1925). C. C. DAVIS

Pulverized fuel for boilers and furnaces. I. W. R. CHAPMAN. *Fuel in Science & Practice* 4, 340-3(1925).—A review and discussion, including the drying of coal, its pulverization and transport, feeders, mixers, burners and combustion chambers.

Motor fuels. J. S. S. BRAME. *J. Roy. Soc. Arts* 73, 920-9, 930-40, 942-54 (1925).—A comprehensive review. C. C. DAVIS
E. J. C.

The problem of liquid fuels (for aircraft engines). GINO GALLO. *Nat. Advisory Committee for Aeronautics, Tech. Memorandum No. 270*, 10 pp.(1924).—Summary and translation of a lecture by G. discussing the motor fuel situation in the light of petroleum reserves, their proper utilization (cracking), the possibilities of synthetic fuels (cf. C. A. 18, 2594), and the use of alc. or mixts. thereof. WM. B. PLUMMER

Methanol and synthol made from carbon monoxide as motor spirit. F. FISCHER. *Brennstoff-Chem.* 6, 233-4(1925).—Road tests were made with a 4-cylinder truck motor, 12 h.p. (75-mm. bore and 130-mm. stroke), the wt. of the truck being 1600 kg. Compression of the motor was raised from 4.6 atm. to 6.0 atm. by change of pistons. Fuels used on the test were: (a) pure methanol, (b) national fuel (benzine: EtOH = 1:1), (c) benzine with 20% kerosene and 2% lead tetraethyl, (d) benzine with 30% kerosene

and 2% lead tetraethyl. Fuel required per 100 kilometers, max. speed on the level, and av. speed, resp., for the different fuels: (a) 221., 80 km. per hr. and 46 km.; (b) 11.6 l., 85 km. and 50 km.; (c) 12.7 l., 93 km. and 62 km.; (d) 11.7 l., 90 km. and 55 km. With pure methanol and 6 atm. compression there was trouble from pre-ignition without detonation; with 5% water the methanol ignited properly. J. D. DAVIS

Combustion control by machinery. C. H. SMOOR. *Iron Steel Eng.* 2, 286-91 (1925).—To make combustion control possible any regulating mechanism must be powerful, sensitive, stable and accurate. S.'s system of regulation applied to gas distribution in a blast-furnace plant is described and illus., also combustion control in a hot-blast stove and to a gas-fired boiler. W. H. BOYNTON

Combustion control. T. A. PEEBLES. *Iron Steel Eng.* 2, 291-3 (1925).—Combustion-control equipment saves fuel and pays for itself several times in a year. W. H. BOYNTON

Automatic combustion control. F. G. BAILEY. *Iron Steel Eng.* 2, 2-4 (1925). cf. C. A. 19, 1044.—The aim for coal-burning equipment should be: (1) one that responds to a minimum no. of control factors; (2) one capable of readily obtaining any desired capacity within the limits of the equipment; and (3) one always maintaining the best efficiency. W. H. BOYNTON

Combustion control. G. S. CARRICK. *Iron Steel Eng.* 2, 294-300 (1925).—General. A lengthy discussion of this and the next three preceding abstracts follows this paper. W. H. BOYNTON

Relation between heat of combustion and volatile matter. F. C. WIRTZ. *Chem. Weekblad* 22, 420-4 (1925).—A lecture. B. J. C. VAN DER HOEVEN

A practical aid in the determination of calorific values. HEINZ KELLER. *Chem. Ztg.* 49, 677 (1925); 4 cuts.—To reduce loss while weighing volatile fuels a container is made by drawing 2 parallel capillary necks on 1 end of a glass tube about 1 to 1.5 cm. long and 0.5 cm. diam. The ends of the ignition wire are drawn through the necks from the open end of the tube until the loop in the wire is inside the tube, the end of which is then sealed. With practice the bulblet may be made in about 3 min., and is filled by suction. J. H. MOORE

The maximum efficiency of heat engines. The future of coal and steam as motive agents. J. S. HALDANE. *Colliery Guardian* 129, 1495-8 (1925). C. C. DAVIS

Furnace heating. VI and VII. R. J. SARJANT. *Fuel in Science & Practice* 4, 276-85, 328-36 (1925); cf. C. A. 19, 2406.—In conclusion a review and discussion are given of the development of reheating furnaces and modern types, the new form of Siemens furnace, the adaptation of preheated air to coal-fired furnaces, semi-gas-fired and gas-fired furnaces, comparative tests of regenerative non-continuous and continuous recuperative reheating furnaces, fuel consumption in reheating furnaces, coal firing vs. gas firing in continuous furnaces, "no load" losses, soaking pits, soaking times, low-temp. heat-treatment furnaces, coal-fired annealing furnaces, sheet annealing and the strength and stability of furnaces. C. C. DAVIS

Study of temperature control, qualitative efficiency, total quantitative efficiency, relative quantitative efficiency, etc. under various conditions of heating and recuperation. J. SEIGLE. *Rev. ind. minérale* 1925, 349-74.—A mathematical paper impracticable to summarize in brief form. Seven cases are considered: (1) furnaces maintained throughout at const. temp.; (2) furnaces in which the heating fluid and the material heated flow in counter directions, their calorific masses being equal; (3) the same conditions as (2) except that the calorific masses differ; (4) furnaces subjected to exterior radiation and not heated; (5) the combination of (2) or (3) and (4), i. e., where the furnace heats a material and at the same time loses heat by radiation; (6) inversion recuperation, such as the Cowper app., recuperation chambers of the Martin furnace, coke ovens, etc. and (7) heating by flame. C. C. DAVIS

The situation of the Middle-German brown coal industry. ANON. *Braunkohle* 24, 541-4 (1925).—Statistics for Jan.-June 1925 are given. The output in that period has in general decreased approx. 15-20%. WM. B. PLUMMER

New Zealand brown coals. Errata. W. O. R. GILLING, J. A. GILMAN AND W. P. EVANS. *J. Soc. Chem. Ind.* 44, 444T (1925); cf. C. A. 19, 2400. E. J. C.

The scientific control of coal washing by the combined application of ash characteristic curves and X-ray examination. WM. McLAREN. *Colliery Guardian* 130, 25, 85-8 (1925).—In connection with a description of the methods developed by Charvet, Henry and Hanappe for characterizing graphically the washing properties of a coal, it is shown that the application of X-rays (cf. *Trans. Inst. Mech. Engineers* 67, 59 (1923)) permits the detn. of the intrinsic ash of the coal and of the ash of the max. associated shale, i. e., the initial and final points of the curves, which have heretofore been ob-

tained only by extrapolation. A further improvement in the ash curve method of examn. is in the prepn. of a "geological section" of the washing bed (the Kemp-McLagen-Thomson technic). It is essentially an X-ray photograph of the material arranged in an ideal manner in a washing bed on the same scale as that of the curve. When this section is placed along the Y_x axis, the relation between the changes in curvature of the various curves and the change of material in the washing bed are strikingly evident. A radiograph of the bed in a Henry tube transparent to X-rays, taken just before sampling in layers, serves as a geological section to place along the resulting curves. Confusion prevalent in the meaning of the term fixed ash can be obviated by limiting it to the constitutional or intrinsic ash associated with the coal substance proper, which is invisible in the radiograph. Any other ash is free or extraneous ash and is theoretically removable by grinting fine enough. The term commercial ash is defined as the sum of the fixed ash and the proportion of free ash permissible in the washed coal. The relation between the fixed and the com. ash varies in coals and can be utilized for controlling the washing. In general it is to fix the com. ash from the data of the ash curves and geological section and to specify that the ash in the washed coal delivered by the jig shall not exceed the com. ash by over 2% for the same % yield of washed product as specified from the section of the ideal bed. A discussion with quant. data is also included of the yield of washed product, float and sink analysis and the Kemp carboscope (cf. C. A. 18, 3703). The article contains numerous photographs and diagrams.

C. C. DAVIS

Treatment of coal slimes by froth flotation processes. O. SCHÄFER. *Stahl u. Eisen* 45, 1-7, 44-51 (1925).—A description, with illustrations, of the application of froth flotation processes to the recovery of coal from the mud and slime collected in the settling tanks attached to coal-washing plants. The importance of grading the recovered coal before drying, to simplify the drying operation, is emphasized. As these concentrates in their wet state carry 50-70% of water, mech. methods of drying have to be used. In those cases where mech. methods yield unsatisfactory results, revolving tube furnaces are used for drying. Tables and diagrams are given showing the efficiencies and costs of the flotation process as operated in 5 German mines. At the Zeche Alma, Gelsenkirchen, the crude slime contains 9-10% of ash, and 92-94% of the coal is recovered as a concentrate contg. 5-6% of ash. In the other 4 mines, with slime contg. 20-40% of ash, the recoveries range from 45 to 72% and the ash content of the concentrate ranges from 7 to 9%.

B. C. A.

Bituminous coal as a generator fuel. H. S. PARKER. *Am. Gas J.* 123, 217-8 (1925).—The economics of blow-run operation, i. e., the balancing of fuel savings against increased oil costs, are discussed. Summarized data of plant tests on 5 different bituminous coals are given. In 3 tests where the gas B.t.u. was 534-5/cu. ft. the cost of fuel plus oil (cents/1000 cu. ft. gas) was, resp., 24.9, 24.4, 24.5. In 2 tests the gas was 543-5 B.t.u., the costs/1000 cu. ft. being 24.9 and 28.1 cents.

WM. B. PLUMMER

Spontaneous combustion in the South Wales coal field. J. IVON GRAHAM AND T. DAVID JONES. *Colliery Guardian* 129, 1561-3 (1925).—In general spontaneous combustion of S. Wales coal depends upon phys. factors such as the thickness of the seam, the friability and the manner of working rather than upon the ready oxidation of any portion of the seam at pit temps. Spontaneous combustion in seams of normal thickness is due to oxidation of finely disseminated pyrites, and in abnormally thick seams to a local accumulation of pyrites, which accelerates the oxidation of the coal. The actual capacity for absorbing O does not increase in areas where the coal has thickened.

C. C. DAVIS

Coal carbonization. H. P. HIRD. *J. Soc. Dyers Colourists* 41, 302-5 (1925).—Various methods of high-temp. carbonization are reviewed and compared. The author's app. consists of a cast-iron retort in the shape of a coke oven with a bottom discharge and furnished with rotating blades in the center. Heat at about 650° is applied to the exterior of the retort. The volatile products drift to the center, which is the coolest part of the retort, and pass out by the passage kept open by the rotating blades. Thus cracking of the hydrocarbons is avoided and a much larger yield of liquid products is obtained. By means of this app. one ton of slack, without briquetting or other previous treatment, yields 1400 lbs. of smokeless fuel suitable for household or com. uses, 5600 cu. ft. of gas (720 B.t.u.), 17 gal. fuel oil, 3 gal. motor spirit and 13.5 lbs. of (NH₄)₂SO₄. The combustible products when burned yield nearly 50% more H.P. than would a ton of the coal burned in a Lancashire boiler and the power produced utilized through a turbine under good conditions.

L. W. RIGGS

Heat of carbonization of coal. J. D. DAVIS, P. B. PLACE AND P. EDEBURN. *Fuel in Science & Practice* 4, 286-99 (1925); cf. C. A. 18, 3700.—The heat of reaction during

carbonization of several types of American coals was detd. by means of a twin const.-vol. calorimeter (cf. *C. A.* 18, 2444). This method gave the sum of the effects of all exothermic and endothermic reactions up to the max. temp. of carbonization. Different max. temps. within the primary carbonization range were chosen to det. the variation in the heat of reaction with the temp. The limiting temp. was 650°, above which the app. was useless. The tests were carried out for the most part in N. Other factors, such as the heat of reaction of anthraxylon and attritus, of the α -, β - and γ -constituents and of the primary carbonization products, the effect of preheating the coal in O and the effect of carbonization in an atm. of H or CO₂ were also studied. It was difficult to det. accurately the heat of carbonization of coal at any given max. temp. because of the inability to control the character of the carbonization reactions. This was particularly true of primary carbonization, where the character of the reactions varied greatly with the temp., a 25% variation between duplicate tests at 500° max. not being unusual. The max. exothermicity of coking coals was about 500°, though s approached 650°. Below 450° they were usually endothermic or, slightly exo. The max. heat evolved for these coals was in no case over 50 cal. per g. Anth gave carbonization reactions less exothermic than did attritus (24 and 37 cal. resp.), probably because the former contains more endothermic coke-cementing constituents. α - and β -compds. were exothermic and γ -compds. endothermic; in 1 case the values were 42, 69 and -27.6 cal. per g., resp., indicating that the coke-cementing constituents are endothermic. The products of primary carbonization were endothermic, i. e., transformation of a primary tar to a secondary tar involves endothermic reactions. Preoxidation at temps. such as 120° rendered the carbonization reactions less exothermic, but preheating in H up to 200° had no effect. Carbonization in H resulted in more exothermic reactions below 450°, whereas above 450° the reactions were usually less exothermic than in N. Carbonization in CO₂ increased the exothermic reactions at 500°, the γ -constituents probably being involved for the most part, since they govern the coke-cementing power and since coal does not coke well in CO₂.

C. C. DAVIS

The present status of low-temperature carbonization in England. H. BROCHE. *Brennstoff-Chem.* 6, 224 (1925).—Low-temp. carbonization is not as yet an economical success in England; the situation is the same in Germany.

J. D. DAVIS

Rates of carbonization of bituminous coal. R. E. THWAITES. *Gas J.* 168, 851 (1924).—A review of the mode of transference of heat from the gas retort to the coal is given. A comparison of various work including T.'s on the relative radiant intensities at different carbonizing temps. with a measured time of carbonization or throughput of coal has led to the conclusion that the heat reaches the coal from the wall of the retort mainly by radiation. As the av. abs. temp. of the coal is unknown it is assumed to be in a const. ratio to the radiating surface if the speeds of carbonization are relative. The av. calcd. difference in temp. of the radiating and absorbing surfaces is 88° and accounts for the low rate of carbonization in gas-works retorts; the explanation offered for the increased rate of carbonization of lignites and mixts. of coal and coke is that the slower evolution of gas and vapors from coal prevents the penetration of radiant heat into the carbonizing material.

B. C. A.

Valuation of gas coals. S. CHEESEMAN. *Gas World* 81, Coking Section, 133-4 (1924).—The valuation of the coal is based upon a study of the proximate analysis, the content of occluded water and the total calorific value. A slightly modified method for the detn. of volatile matter is adopted in order to give results comparable with works practice. The total water evolved on distn. is detd. by distg. 2-2.5 g. of the dried coal in an atm. of dry H, and after removal of the tar by passing the gas through 2 U-tubes contg. glass wool maintained at 108° the water vapor is absorbed in a CaCl₂ tube.

B. C. A.

Locomotive firing with brown coal briquets. NORDMANN. *Braunkohle* 24, 493-502, 513-8 (1925).—Results of tests were satisfactory. As one of the most serious problems is spark-catching, appliances for this are discussed in detail.

W. B. P

Peat in 1924. K. W. COTTRELL. U. S. Geol. Survey, *Mineral Resources of U. S.*, 1924, Part 3, 11-2 (published July, 1925).

E. H.

Grate bars with an aluminium coating. ANON. *Shipbuilding and Ship Age* 1924, 419; *Rev. universelle mines* 7 [7], 116.—Coal often produces a fusible ash which clogs and corrodes grate bars, inhibiting combustion. This difficulty can be obviated by "calorizing" the bars in such a way as to incorporate at least 45% of Al in the outer layer. In service they become coated with Al₂O₃, which m. only at 2300° and resists attack by the ash. After 6 months' service "calorized" grate bars were not attacked noticeably, whereas ordinary bars located in the same hearth lost 0.2 of their wt. and

had to be replaced. In spite of their initial cost, "calorized" bars are finding increasing use in steamship construction. C. C. DAVES

Dissociation of producer gas in the heat exchangers of open-hearth furnaces. JACQUES GUYOT. *Rev. métal.* 22, 615-20(1925).—Investigation of the compn. of the gas before and after its passage through the heat exchanger showed that decompn. occurs, and that it is affected by the presence of the dust in the checker-work. The dust exerts a twofold action: it acts as a heat insulator, and on the other hand it facilitates the decompn. of the gas, which results in an increase in its calorific power. The first action depends on the thickness of the layer of dust, and the second depends on the surface exposed to the action of the gas; so that the purely thermal efficiency of the furnace gradually decreases, the thermochem. efficiency increases to a max., and the net efficiency increases to a max. and then decreases. The calcs. leading to these conclusions are based on the assumption that there are not infiltrations of air, and that the total amt. of N is unchanged by passage through the exchanger. The cal. value per cu. m. of the gas after the exchanger is sometimes higher and sometimes lower than before; but because of the expansion due to decompn. the actual total cal. power is always greater after the exchanger. A. PAPINEAU-COUTURE

The application of blast-furnace gas and air for blowing a gas producer. G. R. McDERMOTT. *Iron Steel Eng.* 2, 269-73; *Blast Furnace & Steel Plant* 13, 344-6(1925).—Blast-furnace gas and air introduced into a producer alternately, in the correct proportions cause no clinker formation. A summary of exptl. runs and a heat balance are given. Also the heat balance of a producer using Western coal and being blown by a mixt. of steam and air. The hot-gas efficiencies in the two cases were 92.7% and 89.7%, resp., and the cold-gas 73.8% and 65.7%, resp. There is almost twice the heat in the moisture in the steam-blown producer as in the producer blown with blast-furnace gas. Discussion brought out the possibility of preheating the air and the blast-furnace gas with waste heat. W. H. BOYNTON

Sampling of gases. J. H. GOLDSMITH. *Gas J.* 168, 847-8(1924).—A 5-cu. ft. gas sampler is used, to which is attached a ball-cock and tank, to enable a sample of gas to be taken over a period at const. rate. Expts. showed that the storage of coal gas over water for 21 hrs. did not within the limits of exptl. error affect the calorific value or the percentage of CO₂. Methods of sampling waste gases and producer gas are discussed, and the importance of the use of silica tubing for sampling is emphasized. B. C. A.

Use of live steam in [gas] purification. F. J. PEARCE. *Gas World* 81, 536-8 (1924).—To overcome the inactivity in cold weather of oxide used for the purification of gas, the temp. of the gas entering the purifier boxes is raised to 49-54° by the admission of live steam at a point 150 ft. from the first box. The boxes are lagged to prevent loss of heat. The vol. of air admitted to the purifiers is such that the amt. of O in the purified gas does not exceed 0.2%. No difficulties are experienced with sudden oxide or back pressure in the boxes. B. C. A.

Carbon disulfide in coal gas. Its formation and elimination. G. GRIFFITHS. *Yorks. Junior Gas Assoc.* Feb. 24, 1925; *Gas J.* 169, 611-3(1925).—Theories for the mechanism of formation of CS₂ in gas manuf. are reviewed. Coals of widely varying S contents were carbonized in a works test plant under defined conditions and except with coals of abnormally high S content, the quantities of total S in the purified gas per ton of coal were approx. proportional to the content of volatile S in the coals. Moderate steaming in vertical retorts appeared to have little effect on the content of S compds. in the gas. The optimum carbonizing conditions resulting in low content of CS₂ in the gas are outlined and methods for its removal reviewed. B. C. A.

The mechanism of the combustion of natural gas in lime-kilns. ZOLTÁN KERTÉSZ. *Gas u. Wasserfach.* 68, 561-3, 578-82(1925).—Tables, curves and formulas are given showing the amt. of gas required for completely burning the CaCO₃, the compn. of the final flue gases, the heat lost in the flue gases, etc., for various amts. of excess air. The air requirements for varying compns. of the fuel gas are also shown. Tables, etc., of similar character are also given covering the use of natural gas in cement kilns. WM. B. PLUMMER

Refractories for gas retorts with special reference to silica. W. EMERY. *Gas J.* (Suppl. July 9, 1924) 3-16.—The analyses and the true and apparent sp. gr. after expansion and contraction of several silica and siliceous bricks have been detd. The transfer of heat is more rapid by silica than by fireclay refractories at temps. above 1000° though the reverse may be true at lower temps. The infiltration of C into the pores of the material invalidates lab. measurements made on the unused refractory. Silica refractories will withstand higher temps. under load than will fireclay and are more resistant to corro-

sion by salt. Silica retorts withstand abrasion satisfactorily. The high reversible thermal expansion of silica and the care required in heating up silica settings are discussed. The necessity of completing as much conversion of the quartz and as great a shrinkage of fireclay as possible in the kiln is emphasized. Fireclay is less liable to spall than silica, but many users of the latter have found no difficulty due to spalling on shutting down. The results of the examn. of several vertical and horizontal retorts after use are described. A. Scott in an appendix describes the microstructure of the materials examd. B. C. A.

Waste-heat and gas-fired boilers. J. W. REBER. *Midland Jun. Gas. Assoc.* Feb. 27, 1925; *Gas. J.* 169, 529-32(1925).—A waste-heat boiler installation fitted to a typical carbonization plant will reduce the stack losses from 42.2 to 14.8% of the heat supplied to the producer. The amt. of steam which can be generated can be calcd. from the temp. of the waste gases, the fuel consumption, and the CO_2 content of the gases. The CO_2 content of the gases should be as high as possible and infiltration of gas from the retorts prevented. Fire-tube boilers are preferred to water-tube boilers, as less space is required to create the necessary draft. The Woodhall-Duckham-Cochran type gas-fired vertical surface-combustion boiler is described. This gives an evapn. of 100 gal. per sq. ft. of heating surface with an efficiency up to 90%. Until the price of gas is reduced considerably, gas-fired boilers can only compete with coal-fired boilers, where ground space is valuable. B. C. A.

Activated carbon and silica gel for recovering benzene from gas. E. URSCH. *Gas J.* 167, 449(1924).—The relative advantages of activated C and silica gel for the recovery of benzene from coal gas are discussed with special reference to the activated C plant at the Grenoble Gas Works. In this plant the consumption of direct steam for the removal of the benzene is reduced by heating the C externally and only admitting direct steam when the temp. attains 100° . With a plant capacity of 1200 l. the steam averaged 2.0 kg. per l. of benzene recovered. Analysis of the benzene showed that it conformed without rectification to the specification for motor spirit. Naphthalene and cyanogen compds. are also removed by the C. U. differs from Williams (C. A. 18, 1897) as to the superiority of silica gel over activated C and recommends the use of activated C for the recovery of benzene from gas. B. C. A.

Cleansing the benzene plant. J. M. WYSEHALL AND G. L. EMPSON. *Gas World* 81, 78-80(1924).—The scrubbers of a benzene plant were cleansed by circulating unwashed solvent naphtha through them. The benzene make was so increased that the cost of cleansing was paid for in 8 weeks. B. C. A.

Waste heat in benzene removal. O. GUILLET. *Soc. Tech. Gas*, June, 1924; *Gas World* 81, 136-7(1924).—Waste heat from recuperator gases at an almost const. temp. of $200-220^\circ$ may be utilized for removing C_6H_6 from wash oil. The cold oil from the scrubber is heated to about 60° by the vapor distg. from the crude benzene still. It is then passed into a worm in the hot gas space, where its temp. is raised to 130° , and afterwards ascends a column, also in the gas space, into which a small quantity of steam is also led. The C_6H_6 -free oil from the column passes to a cooler and thence to the scrubber, free from water, the mixed vapors leaving the column at 130° . After the crude benzene is condensed and the water sepd., the former passes to a small boiler capable of holding 24 hrs. make, immersed in a controlled branch of the gas stream at 200° . The boiler is also provided with a supplementary heating worm. The benzene vapors pass away at 140° and are condensed and collected. At a given moment the temp. suddenly drops, and the residue (5-7% of the whole) is drawn off, set aside to deposit naphthalene, and the residual oil added to the wash oil. The water condensed is slightly less than half the crude benzene produced, and for rectification the steam required is about 10% of the light benzene produced. The oil thickens and requires renewal every 3 months. The method has been tested at a works making 53 million cu. ft. per annum of gas of 470 B.t.u.; 1.554 lb. of light benzene was recovered per 1000 cu. ft. of gas, leaving 0.409-0.467 lb. of benzene in the gas. The oil from the scrubber contained traces of water and gave 4% at $0-120^\circ$, 1.5% at $120-200^\circ$, 13% at $200-270^\circ$; that from the benzene remover gave traces of water, 0.8% at $0-120^\circ$, 1% at $120-200^\circ$, and 12.5% at $200-270^\circ$. The crude benzene gave 51% at $0-100^\circ$, 18% at $100-120^\circ$, 12% at $120-150^\circ$, 10% at $150-200^\circ$, 8% at $200-240^\circ$. The rectified benzene gave 80-85% at 100° ; dry point, $145-150^\circ$. The advantages are almost complete retention of naphthalene and large retention of CS_2 and HCN. The disadvantages are a loss of calorific value of 22-45 B.t.u. per cu. ft. of gas and a loss of vol. of 89 cu. ft. per ton. B. C. A.

Effluents from ammonia plants and their disposal. T. LEWIS BAYLEY. *Chemistry* 44, 835-45(1925).—The principal injurious constituents in NH_3 -plant wastes are CN , $(\text{NH}_4)_2\text{S}_2\text{O}_8$, NH_4CN , PhOH , and tar acids. When charged in quantity

into the local sewers, the effluent interferes with bacterial treatment of sewage; when discharged to water courses, it harms fish. Methods for removing these constituents from the effluent are difficult and impracticable. The best practice is to minimize the formation of these products during carbonization. The use of a liquor spray to remove the tar at an early stage of the operation minimizes the amt. of tar in the NH_3 liquor. Exclusion of air from the carbonizing system minimizes the formation of NH_4SCN and $(\text{NH}_4)_2\text{S}_2\text{O}_7$. Bacterial treatment of the effluent has proven effective, but it has the disadvantage of requiring large ground space. T. S. CARSWELL

Physical conditions in the sulfate of ammonia saturator. H. M. LOWE. *Gas World* 81, Coking Sect., 73-5 (1924).—In the recovery of NH_3 as $(\text{NH}_4)_2\text{SO}_4$ from coke-oven gas, the heat of reaction is more than sufficient to evap. all the mother liquor present, and yield solid salt if the conditions in the saturator are properly controlled. This applies both to the direct and semi-direct processes. The excess of heat is greatest when the temp. of the gas entering the saturator is about 35° , and least when the gas is at its dew-point (about 77°). Above that temp. the excess of heat available increases rapidly. At 77° the quantity of water which on theoretical grounds must be added to remove the excess of heat is 10% of the wt. of $(\text{NH}_4)_2\text{SO}_4$ produced; at 35° it is 28%. In practice radiation losses reduce these figures. If the ovens are leaking and drawing in air the NH_3 content of the gas treated decreases, there is more gas to be heated in the saturator, and it is then more difficult to avoid formation of mother liquor contg. dissolved $(\text{NH}_4)_2\text{SO}_4$ in addn. to the solid salt. (Cf. Still, *Coke Oven Managers' Year Book*, 1920.) B. C. A.

Manufacture and neutralization of sulfate of ammonia. C. BATEMAN. *Gas J.* 166, 750-2 (1924).—The Wilton $(\text{NH}_4)_2\text{SO}_4$ plant is described. B. effects neutralization by spraying in the centrifuge with 0.5% NH_3 soln. prepd. by distg. $(\text{NH}_4)_2\text{SO}_4$ with lime. The free acid is previously reduced by washing with hot water to 0.2%, this being the min. attainable by the use of water alone. For the water spray a Korting's atomizer is used and for the NH_3 soln. a specially constructed wide-mouthed spray nozzle. Neutralization is also assisted by turning the salt while in the centrifuge. The salt should be dried as soon as possible after neutralization. In this process the chief difficulties are the formation of salt incrustations in the saturator owing to the greater quantity of washings returned to it and the corrosion of the Cu parts of the centrifuge. B. C. A.

The reduction of carbon monoxide to methane in the presence of various metals. F. FISCHER, H. TROPSCH AND P. DILTHEY. *Brennstoff-Chem.* 6, 265-71 (1925).—Various metals reduced at low temp. from the oxides where possible (Co, Fe, Mo, W, Ru, Pd, Os, Ir, Pt, Ag, Cu, Rh) were tested with and without admixt. of Al_2O_3 at various temps., 100 – 800° , for conversion of CO and H mixts. to CH_4 . Ru gave the best results, viz., 34.4% CH_4 in exit gas at 300° with a mixt. $\text{CO}_2:\text{H} = 1:5$ at 12 cc. gas flow per min. The use of Al_2O_3 as a carrier of metals proved advantageous particularly in the case of Fe. The order of the catalytic activity of the metals tested was Ru, Ir, Rh, Ni, Co, Os, Pt, Fe, Mo, Pd, Ag. J. D. DAVIS

Effects of indene on naphthalene determination by picric acid. H. G. COLMAN AND E. W. YEOMAN. *Gas J.* 168, 347 (1924).—The statement of Brown and Berger (*C. A.* 18, 3266) that the picrate method of detg. C_{10}H_8 gives unreliable results in presence of indene does not apply if the picrate ppt. is recrystd. from hot aq. picric acid as recommended by Colman and Smith (*J. Soc. Chem. Ind.* 19, 128 (1900)); the other picrates are then substantially eliminated, the recrystd. material consisting of naphthalene picrate except for small quantities of picrates of homologs of C_{10}H_8 . B. C. A.

A study of the oils (tars) from the low-temperature carbonization of coal. A. BRITTAIN, F. M. ROWE AND F. S. SINNATT. *Fuel in Science & Practice* 4, 263-9, 299-307 (1925).—Two different oils from the carbonization of coals at 600° were resolved into their components by fractional extn., the individual fractions including: (1) solids insol. in Et_2O but sol. in phenols, PhNH_2 and $\text{C}_6\text{H}_5\text{N}$ and contg. N and a high % of S; (2) neutral oils of the naphthalene and anthracene series which formed picrates, which comprised resins with high b. p. and which represented about 30% of low-temp. pitch; (3) neutral oils which did not form picrates, which consisted of paraffins and naphthene, unsatd. cyclic and aliphatic hydrocarbons and which contained no resins, but contained solid paraffins in the higher fractions; (4) phenols and acid resins; (5) bases and (6) carboxylic acids in traces. The solids insol. in Et_2O are largely responsible for the emulsifying properties of low-temp. oils. Naphthalene and anthracene were found and indications pointed to the presence of α - and β -methyl, α - and β -ethyl-, and 1,6-dimethylnaphthalene. The neutral resins were probably aromatic. H_2S was present; CS_2 and thiophene were absent, though the presence of the latter may have

been masked by interference from unsatd. hydrocarbons. All the components of the low-temp. oils contained S insol. in Et_2O , especially the solids. The phenols in the tar consisted chiefly of homologs of phenol and acid resins. Of the cresols, the *o*-isomer was present in the largest proportion, the *p*-isomer in the smallest, which is contrary to previous investigators. Phenol itself was present only in traces and catechol was found only in the aq. distillate and in a quantity too small to be of com. value. The bases were chiefly secondary and tertiary, only traces of primary bases being found. $\text{C}_6\text{H}_5\text{N}$ was not identified in the bases isolated from the tar. HCO_2H , HOAc , AcH , PhOH , *o*-cresol, Et_3NH , NEt_3 , $\text{C}_6\text{H}_5\text{N}$, methylpyridine and unidentified ketones were present in the aq. liquor, but acetone could not be detected. The amt. of *o*-cresol confirmed the earlier conclusion that it predominated in the cresol fraction of the tar. A bibliography of 100 references is included.

A contribution to the knowledge of phenols from primary tar. A. WANDER. *Brennstoff-Chem.* 6, 217-21, 234-8(1925).—From the phenolate liquor from low-temp. tars W. obtains "e-phenols," which are extractable with ether and C_6H_6 , and "ne-phenols," which are not extractable but which can be recovered from water soln. by pptn. with mineral acids. Three phenol fractions were studied, (1) b. 230-310°, (2) b. 222-230°, and (3) b. 100-107°. The source of phenolates used were generally tar and a rotary-retort tar. The distribution of the two phenol classes in the phenolates was: fraction (1), e-phenols 50%, ne-phenols 47.2%, loss 2.8%; fraction (2) e-phenols 34%, ne-phenols 51%, loss 15%; fraction (3) e-phenols 24.1%, ne-phenols 75.9%. The e-phenols are the more unstable of the two classes; they decompose to a considerable extent on distn., yielding humic acids and asphalt-like matter. e-Phenols are the more complex (higher av. mol. wt. and higher b. p.), probably do not form true phenolates, but are merely sol. in NaOH. Constitution of individual phenols is not detd.

J. D. DAVIS

The phenols of lignite tar oils. A. MAIHLE. *J. usines gaz* 49, 286-70(1925).—The prepn. and properties of (Minervoisi) lignite tar have been previously discussed (cf. C. A. 19, 2402). The 1st 5 fractions of the phenols, covering the range 188-225°, consist of PhOH , *o*-, *m*-, and *p*- $\text{MeC}_6\text{H}_4\text{OH}$, and 1,3,4- $\text{Me}_3\text{C}_6\text{H}_2\text{OH}$; these are identified by prepn. of the phenylurethans of the fractions, also by nitration of their Me ethers as prepd., MeI being used with KOH. For purposes of comparison the phenylurethans of various pure phenols were prepd. and their m. ps. detd.; the deriv. of PhOH , m. 124°; the derivs. of *o*-, *m*-, and *p*- $\text{MeC}_6\text{H}_4\text{OH}$, m., resp. 141°, 122° and 110°; those of 1,3,4-, 1,4,5-, and 1,2,4- $\text{Me}_3\text{C}_6\text{H}_2\text{OH}$ m., resp. 103°, 163° and 183°. WM. B. PLUMMER

Note on determination of tar with the Fischer aluminium assay retort. O. KÜNLE. *Brennstoff-Chem.* 6, 238(1925).—In the ordinary use of this retort (C. A. 14, 2071) error is caused by tar adhering in the outlet tube. This tar can be estd. by distg. 20 cc xylene from the retort after the carbonization is finished, catching the distillate in a clean flask, evapg. at 140° and weighing.

J. D. DAVIS

The testing of coke. I. G. E. FOXWELL. *Fuel in Science & Practice* 4, 353-6(1925).—Recognized methods of sampling and detg. the true and apparent d. porosity, resistance to shattering and tumbling and crushing strength are outlined. C. C. S

Coke reactivity. E. C. EVANS. *Colliery Guardian* 130, 143-4(1925).—On account of the inadequacy of methods so far developed for estg. the reactivity of cokes the attempt was made to det. this property by passing a standard vol. of CO_2 at a standard rate over a standard vol. of coke (10-20 mesh) at 950° and measuring the vol. of CO formed. The results are empirical but agree within 2% in successive expts. on the same coke. The following data represent the relative vols. of CO obtained: theoretical coke of max. reactivity 200, active C 192, S. Wales metallurgical coke 78, Scotch metallurgical coke 54, Glover-West high-temp. retort coke (Durham coal) 119, same (Ravine coal) 182, Beehive coke (Durham coal) 30. In conjunction with chem. analyses the results indicate that in general low-temp. coke is more reactive than normal gas or coke-oven coke and has the advantage of easy ignition and smokeless combustion. Research should be directed towards the perfection of an abs. method of detg. reactivity of a fuel with CO_2 at different temps. and concns., the coordination of this with the results of the CO_2 method and a comparison of all these results with those obtained with larger sized material. A discussion is included of the factors governing coke reactivity and methods of increasing the reactivity of high-temp. coke.

C. C. DAVIS

Gasification of coke in steam with special reference to rates of gasification and the composition of the gas. S. PEXTON AND J. W. COBB. *Gds J.* 167, 181-9; *Gas World* 80, 675-8(1924).—In order that the results should be comparable with those previously reported by Pexton and Cobb (C. A. 17, 3089), the samples of coke used were all prepd. from Blackwell (Derbyshire) coal. Three types of coke were examd.,

2 prepd. in the lab. at 600° and 1270°, resp., and the third in large-scale coke ovens. The coles were crushed and graded to $\frac{1}{10}$ in., $\frac{1}{8}$ in. and $\frac{1}{4}$ in. According to the method of expt. a steady stream of N satd. with steam at a known temp. was passed through a column of coke (3 in. in length and 1 in. diam.) maintained at a desired temp. The steam was passed at different rates and the compn. of the gas produced and the amts. of steam decompd. were detd. In the first series of expts. the works oven coke was gasified at 900°. With a time contact of 2 seconds 25% of the steam was decompd. and the water gas produced contained 15% of CO and 24% of CO₂. With medium temp. (900°) lab. coke gasified at 900°, 40% of the steam was decomposed and the gas produced contained 24% of CO and 17% of CO₂. It is concluded that the production of high-grade water gas is unlikely under conditions which favor NH₃ preservation. The remaining series of expts. was conducted at 1000°. With the works oven coke and time contacts of 3 or 4 seconds, the water gas produced was extremely low in CO₂ and conditions approached very nearly to the high-temp. primary reaction, $C + H_2O \rightarrow CO + H_2$. As the rate of steam supply was increased, the percentage decompd. diminished; but the products of gasification were in equil. down to times of contact so low as $\frac{1}{2}$ second, beyond which a gradual departure was noted. When the high-temp. lab. coke was gasified at 1000°, the steam decompn. was less extensive than with the works oven coke; the lab. coke gasified at approx. $\frac{2}{3}$ the rate of the works coke. For a time of contact of 1 second, the products were in equil., but for smaller times of contact equil. was not established. When the medium-temp. coke was gasified at 1000°, with a time of contact of 1 second, the CO₂ content of the gas was 1% as against 10.8% with the high-temp. coke. The rates of gasification of the C of the 900° coke, the 1270° coke, and the works oven coke at 1000° for a rate of steam such that the time of contact was 2 seconds were as 10:7:5. The results in general are compared with those obtained on the large scale by the Gas Investigation Comm. of the Institution of Gas Engineers. The differences are attributed to steam having passed through the fuel-bed in the large-scale expts. without adequate opportunity of reacting with the C and gaseous products.

B. C. A.

By-product coke-oven practice. VII and VIII. R. A. MORR. *Fuel in Science & Practice* 4, 310-21, 344-52 (1925); cf. C. A. 19, 2407.—An illustrated review and description of the Simplex, Huessner, Collin, Wilputte, Koppers-Taper, Becker, Otto, Simon-Carves and Piette ovens.

C. C. DAVIS

Flow of gases in the coke oven. T. B. SMITH. *Gas World* 82, Coking Sect., 10-2 (1925).—To confirm previous observations (C. A. 16, 2208) of the flow of gas in coke ovens a specially designed app. was used which was placed in the oven during carbonization. By the aid of a series of connecting pipes SO₂ was injected and the gas analyzed from different parts of the app., and the direction of travel of the gas thus ascertained. The direction of flow of the main stream of gas is inwards, with an upward tendency, until disturbed by the contraction of the charge and the formation of fissures in the coke. The upward tendency increases as carbonization proceeds. The layer next to the wall contracts over the area of the wall, when fully coked, and forms small fissures which deepen as the process proceeds and as the layer of fully carbonized coke widens. The plastic layer does not appear to affect to any extent the path of travel of the gas.

B. C. A.

Manner of evolution of water of constitution during low-temperature coking. E. LAZLO. *Brennstoff-Chem.* 6, 221-4 (1925).—L. carbonized two Hungarian coals in the Fischer lab. rotary retort and detd. separately the amount of water colloiddally adsorbed and water of constitution. The coals contained, resp., 36.37% total water, of which 11.53% was water of constitution, and 23.45% total water, of which 10.7% was water of constitution. Adsorbed water was all evolved from the first coal at 136° and from the last at 170°. Curves giving the yield of distillate with increasing temp. show that there is no sudden variation in the rate of evolution of combined water except at around 400°, where the rate of evolution of gas and tar is also a max.

J. D. D.

Generation of steam from coke breeze. JOHN VAN BRUN. *Iron Steel Eng.* 2, 274-6 (1925).—Coke breeze may be used with good results on a well-designed stoker installation with preheated air. Recent developments in the air preheater should permit an overall efficiency of stoker, boiler and air preheater with coke breeze of 80%. For fuel contg. large % of fines the introduction of two arches—one short arch at the front end of the grate and a long sloping rear arch extending from the ashpit wall forward to within 1 m. of the front arch is advisable. This construction requires that the air pressure under the grate be lower in the front and higher toward the rear. This causes a forward gas flow at fair velocity. Any finely divided C blown from the fuel bed drops on the front end of the grate. Air leaking through the ashpit or under the

stoker must pass over the fuel and through the narrow throat between the arches, resulting in high CO_2 with 3-5% increased efficiency at corresponding combustion rates.

W. H. BOYNTON

Coke breeze. G. C. EMMONS. *Iron Steel Eng.* 2, 276-85 (1925); cf. preceding abstract.—Coke breeze is a difficult fuel to handle. The difficulties with underfeed stokers and the type of stoker specially designed for coke breeze are noted. The double arch construction permits much better gas mixt. and gas combustion, much improved ash, and very much improved ignition without back pressure, therefore with lower furnace maintenance. E. gives 13 recommendations or selections on furnace construction and operation. Discussion of this and the paper abstracted above brought out the advantage of rectangular water boxes in sidewall construction. 'Carborundum brick' is not suitable for sidewalls for bituminous coal but is satisfactory with anthracite. 'Coke' producer gas is ideal for direct-fired, low-temp. operations such as heating sheet and pair furnaces, annealing and heat-treatment furnaces and for galvanizing, tinning, wire patenting, Pb baths and other operations up to 1150° . The chem. analysis, heating value and combustion data from a plant using coke breeze are shown. W. H. B.

Fuel in the iron and steel industry (EVANS) 9. Corrosion by city gas (TUNNICLIFFE) 9. Critical discussion dealing with CO , CO_2 and H_2 —application to gas producers (THIBEAU) 2. Bituminous emulsions [for coal-briquetting] (Brit. pat. 236,177) 72.

Fuel. J. R. HINMAN. Brit. 230,252, Feb. 25, 1924. "Garbage, shaving, paper waste, weeds or other combustible waste is ground with clayey earth and mixed with oil.

Motor fuel. T. MIDGLEY, JR. Can. 251,325, June 30, 1925. A motor fuel consists of cyclohexane 80 and benzene 20%.

Motor fuel. C. F. KETTERING and T. MIDGLEY, JR. Can. 251,326, June 30, 1925. A motor fuel contains kerosene $96\frac{1}{2}\%$ and aniline $3\frac{1}{2}\%$.

Liquid fuel. E. TERRY. Brit. 230,354, Aug. 15, 1924. "Motor spirit" is formed of acetone mixed with 1-3 times its vol. of C_6H_6 , gasoline, kerosene, naphtha or "paraffin."

Liquid fuel. E. H. RECORDS. Can. 249,287, May 5, 1925. A fuel contains alc. 81.5, benzene 10.0, Et_2O 5.0 and naphthalene 3.5%.

Fuel and ore briquettes, etc. T. NAGEL. Brit. 230,306, May 5, 1924. H_2PO_4 (or an acid phosphate) and blackstrap molasses or similar material are used together to form a binder. Cf. C. A. 19, 1191.

Preparing fuels for briquetting. P. C. MULLIGAN and H. G. SWALWELL. U. S. 1,551,966, Sept. 1. In prepg. carbonized sawdust, wood chips or similar fuels for briquetting, a solid binder such as asphalt is pulverized and incorporated with carbonized wood waste or other combustible base used, after impregnating the latter, in granular condition, with a liquid hydrocarbon material, e. g., fuel oil.

Fuel consumption indicator for explosion engines. F. W. DAVIS. U. S. 1,552,119, Sept. 1.

Apparatus for the distillation of coal or similar substances. H. DUPUY. U. S. 1,551,814, Sept. 1.

Carbonizing coal in vertical retorts. S. P. CURTIS. Brit. 230,281, March 24, 1924. Mech. features.

Apparatus for drying, carbonizing and distilling coal, shale, etc. A. M. DUCKHAM, D. RIDER, J. S. WATTS and THERMAL, INDUSTRIAL and CHEMICAL RESEARCH CO., Ltd. Brit. 230,223, Jan. 17, 1924.

Separating ash-forming constituents from coal by flotation. I. T. BATES. U. S. 1,552,197, Sept. 1. Coal is simultaneously pulverized and heated in the presence of oil and substantial absence of H_2O , in order physically to detach impurities from the coal and is then subjected to froth flotation to recover the purified coal particles freed from ash.

Distilling wet combustible material. O. HUBMANN. U. S. 1,551,956, Sept. 1. Wet material which is to be distd. is moved successively through a drying zone and then through a distg. zone. In the distg. zone, a flow of combustible gas, heated to distg. temp. is maintained. At least part of the gaseous products from the material are burned and the products of combustion are passed through the material in the drying zone.

Water-gas plant. G. E. WHITWELL. Brit. 230,217, Jan. 12, 1924.

Gas scrubber. S. HERSEY, F. W. STOKES and KIRKHAM, HULETT and CHANDLER LTD. Brit. 230,243, Feb. 9, 1924.

Coke oven. KOPPERS CO. Brit. 230,167, Dec. 4, 1923.

22—PETROLEUM, LUBRICANTS, ASPHALT AND WOOD PRODUCTS

F. M. ROGERS

Petroleum in 1923. G. B. RICHARDSON. U. S. Geol. Survey, *Mineral Resources of U. S. 1923*, Part II, 365-420 (preprint No. 31, published Aug. 27, 1925). E. H.

The significance of Edeleanu's process in petroleum refining. H. I. WATERMAN AND J. N. J. PERQUIN. *Chem. Weekblad* 22, 389-93 (1923).—Results are given, obtained with liquid SO_2 extn. according to Edeleanu (*C. A.* 18, 750) for the refining of Venezuelan, Californian and Mexican kerosene. The end products, after treatment of the oil with 70 vol. % SO_2 in counter-current at -10° , were very satisfactory (80% yield), particularly when the refined oil was subjected to a subsequent treatment with $1\frac{1}{2}\%$ FeO_4 + 2% oleum. The SO_2 losses were small (0.3%), the desulfurization (between 75 and 80%) more efficient than that by either silica gel or hypochlorite. The character of the hydrocarbons in the refined product has changed considerably as shown by an increase of 12° of the aniline point (cf. Tizard and Marshall, *C. A.* 15, 1867; Waterman and Perquin, *C. A.* 16, 2281); exposure of the refined oil to ultra-violet light caused only a slight coloration; the yellow-brown SO_2 ext was decolorized by it. Transformer oil (Mid-Continent) extd. with 100% SO_2 four times at -10° yielded 80% of a product, which became colorless after bleaching with 2% franconite S (90°, 20 min.), had a bromine value 2.6 (original 2.4), aniline point 93.0° (original 80.7°), sludging value 0.7 (original 1.3), sulfur content 0.12% (original 0.35%). Ordinary refining with concd. H_2SO_4 did not give as good results and is less efficient; from the bromine values it appears, that only objectionable unsatd. compds. are removed by the "physical" extn. with liquid SO_2 . Expts. on the prepn. of "white oil" and medicinal oil from Russian and Californian distillates gave satisfactory results, better yields than usually obtained. Also for the refining of vegetable and animal oils liquid SO_2 will be of great value; it tends to take up the highly unsatd. glycerides. B. J. C. VAN DER HOEVEN

Desulfurization of petroleum distillates with silica gel. H. I. WATERMAN AND J. N. J. PERQUIN. *Brennstoff-Chem.* 6, 255-7 (1925).—Different samples of gel were prepd. from com. water glass by pptn. with HCl or H_2SO_4 and activated either in dry air at 200° or *in vacuo* at 300° . A com. sample was also used. All were about equally efficient. Sulfur-free kerosene from Borneo, to which various org. S compds. had been added, was shaken 5 times with gel, fresh gel being used each time and the shaking lasting 8 hrs. The S reduction for the various S compds. was: $(\text{C}_6\text{H}_5)_2\text{S}$ 33%, $\text{C}_6\text{H}_5\text{SH}$ 31%, $\text{C}_6\text{H}_5\text{NCS}$ 88%, $\text{C}_6\text{H}_5\text{NCS}$ 17%, $(\text{C}_6\text{H}_5)_2\text{SO}_4$ 100%. Treatment of com. S-contg. distillates resulted in 20 to 50% S reduction, depending on the nature of the oil. J. D. DAVIS

Sludge formation in transformer oils. H. VON DER HEYDEN AND K. TYFKE. *Elektrotechn. Z.* 46, 737, 889 (1925). C. G. F.

Oil purification plant on wheels. A. H. NICHOLSON. *Elec. World* 86, 567 (Sept., 1925).—A 1-ton truck chassis is equipped with a special body to carry equipment necessary to purify transformer oil at the rate of 300 gal. per hr. A motor-driven centrifugal separator is an important part of the app. Oil that breaks down below 20 kv. is treated, being drawn from the bottom of the transformer, purified and returned to the top of the transformer without interrupting service, with a loss of less than 1 gal. per 1000. Heating coils of 12 kw. capacity keep oil at a temp. of $50-60^\circ$ and facilitate removal of H_2O . H. STOERTZ

Automobile fuel and the public health. P. E. MORHARDT. *La nature* 53, 1, 70 (Suppl. (1925)).—A discussion of the physiol. effects of gasoline contg. Pb compds. and the recent work of Zannger (cf. *Schweiz. med. Wochschr.* 1925, no. 2, 26). C. C. D.

Comparative investigations of various types of charcoal furnaces commonly used in Sweden. SECOND REPORT FROM THE CHARCOAL COMMITTEE APPOINTED BY THE JERNKONTORET AND THE ENGINEERING ACADEMY. *Jernkont. Ann.* 109, 165-97 (1925).—The furnace types investigated were the Aminoff, the blower and the tube-car furnaces. The two first-named have the least fuel consumption; for these in this respect there is a slight difference in favor of the former, an advantage which is more than compensated by a lower output of wood spirit as compared with the latter. In tube-car furnaces considerable amts. of condensable and incondensable by-products are lost by leakage from the furnace chamber, a loss which may be reduced by placing a blower after the condensing system. Since the gas is used in full or in part for firing the furnace, the fuel consumption is reduced in the like proportion by this measure. At several of the works at which the investigations were carried out the method of firing was inefficient. In some expts. with tube-car furnaces the incondensable gas after being cooled down to

20° was washed in a tower with circulating liquid. It then appeared that 10–15% of the total output of wood spirit was obtained in this tower, and this wood spirit (from the tower) contained more acetone than did that from the condensers. The outputs of AcOH and wood spirit obtained in the blower furnace show that at least the latter is not destroyed by the temp. usually prevailing in this furnace. C. H. A. ROBAK

Carbonization of bark. HILDING BERGSTROEM. *Jernkont. Ann.* 109, 157–9 (1925).—Comparative expts. with bark and pure wood from spruce, red fir and birch were carried out in a 35-l. retort heated indirectly by gas. The volatile combustion products were taken out at the top of the retort and condensed at first in a copper and then in a glass cooler. The incondensable gas was measured and analyzed. The carbonization lasted for 3–6 hrs. at a max. temp. of 400–50° at the bottom and 450–500° at the top of the retort. The results show that bark gives a somewhat higher output of charcoal and tar and a little less of wood acid, AcOH and methanol than does the corresponding wood. Particularly the spruce bark was very difficultly carbonizable. C. H. A. ROBAK

The carbonization of wood in the forest. JACQUES BOYER. *La nature* 157, 65–9 (1925).—A description of portable ovens for the production of wood charcoal with photographs of the operation of the Magnein, Krug, Dehommeau, Trihan, Lambert, Frey and Ringelmann ovens. C. C. L.

Ignition temperature of charcoal. HILDING BERGSTROEM. *Jernkont. Ann.* 109, 2 (1925).—Previous expts., reported in C. A. 19, 1049, show that charcoal at a final carbonization temp. of about 425° has the max. power of absorbing O₂; consequently the max. danger of spontaneous ignition during storage. A new expt. shows that this fact stands in good accord with the variation of the ignition temp. in charcoals produced at different final temps. The ignition temp. is min. in charcoals produced at 425° or thereabout. Even after storage in air for 14 days at 25° this min. ignition temp. was retained. C. H. A. ROBAK

Oils (tars) from the low-temperature carbonization of coal (BRITAIN, *et al.*) 21. Liquid fuels (GALLI) 21. Apparatus for drying, carbonizing and distilling shale (Brit. pat. 230,223) 21.

OBERFELL, GEORGE G. and ALDEN, R. C.: **Natural Gasoline, Testing, Manufacturing and Properties.** Chicago: W. B. Conkey Co. 533 pp.

Purifying petroleum oils. R. F. DAVIS. U. S. 1,551,806, Sept. 1. Distillates from cracking asphaltic oils or other petroleum oils are subjected to the action of Cu oxide and of light high in ultra-violet rays.

Cracking hydrocarbon oils. F. G. NIECE. Brit. 230,339, July 11, 1924. Oil or vapors together with uncondensed gases are passed through molten Pb or similar material. An app. is described.

Preventing evaporation of light hydrocarbons. J. H. BRIGGAT. Brit. 230,311, May 9, 1924. Gasoline or similar material is treated with 2–4% of hexahydronaphthalene, decahydronaphthalene, hexahydrophenol or other easily combustible hydrogenated aromatic compd. b. above 150°.

Treating oil with adsorbent earths. F. W. MANNING. U. S. 1,552,072, Sept. 1. After mixing hydrocarbon oil with finely divided adsorbent earth the oil is subjected to filtration through a layer of the treating earth which is built up in the app. used. Soakage oil is subsequently removed from the adsorbent earth and the latter is then roasted to prepare it for reuse.

Apparatus for treating oils with adsorbent substances and inert gases while heated. P. W. PRUTZMAN. U. S. 1,551,909, Sept. 1.

Vertical retort for distilling oil from shale. R. H. CROZIER. U. S. 1,551,941, Sept. 1. The retort has both external and internal heating flues.

Apparatus for separating oil from water. T. FISHER. Brit. 230,042, Feb. 28 1924.

Bituminous emulsions. H. A. MACKAY. Brit. 230,177, Dec. 5, 1923. Molten asphalt or other bituminous material is treated with a small proportion of casein or other protein substance and then with a dil. alk. soln. and hot H₂O to obtain emulsions for road-making, coal-briquetting, preserving roofing felt, etc. Starch, oleic acid and other ingredients also may be used. Cf. C. A. 19, 3159.

Plant and retort for the treatment of wood. F. K. FISH, JR. Can. 250,608, June 9, 1925.

23—CELLULOSE AND PAPER

CARLETON E. CURRAN

Cellulose fiber. J. O. HERZOG. *Ber.* 58B, 1254-62(1925).—Tension during growth probably causes the orientation of crystallites in the fiber. It is well marked in cuprammonium silk, especially if tension during spinning is prolonged. In viscose, where the rapidity of the process is governed by ionic reactions, it is not evident. The natural fibers are more complicated in structure but consist primarily of isotropic substances in which the cryst. material is formed either by excess of the crystg. compd., or by the transformation of a compd. already present. On cautious nitration or acetylation topochem. changes occur in the cellulose mass without alteration of the crystallite or micellae. The processes of deformation caused by pressure or tension can be explained by regarding the fiber as a two-phase system consisting of crystallite and inter-crystallite material. W. H. SWANSON

Oxycellulose. HUGO KAUFFMANN. *Textilber.* 6, 591-2(1925).—The "boil off number" of 1 g. of cellulose is the no. of cc. of 0.1 N KMnO₄ reduced by the ext. at 75° with 0.25% NaOH, and the "oxygen number" the no. of cc. required for complete on of cellulose to CO₂ + H₂O. Expt. indicated 1470 ± 0.9 rather than the ical 1480.7 as the practical O no. of cotton. The content of cellulose in a sample estd. by removing the oxycellulose with NaOH and comparing the O no. of the with 1470. The boil off no. of overbleached cotton cellulose indicates 939 as l. wt. of the oxycellulose so formed. E. R. CLARK

Carbohydrate constituents of sulfite pulp. H. KRAUSE. *Cellulosechem.* 5, 88 (1924).—Polemical. The objections of Hägglund and Klingstedt (*C. A.* 18, 3113) to K.'s method for the sepn. of fructose from lignin-contg. liquors are refuted by K. Provided the evapd. liquor still contains enough H₂O, and is thoroughly mixed with sand, fructose may be quant. removed from lignin by the use of EtOH-Et₂O mixts. K. does not deny that other sugars may also be removed by such treatment. LOUIS E. WISE

product of this stage is treated with a limited quantity of a strong condensing agent.

Liberating fiber. G. A. RICHTER. *Can.* 252,584, Aug. 11, 1925. Cellulose fibers are liberated by digesting material which contains cellulose with a soln. contg. Na₂S and Na₂SO₃.

Treating waste sulfite liquor. G. C. HOWARD. U. S. 1,551,882, Sept. 1. Waste sulfite liquor is mechanically agitated and aerated and simultaneously treated with a reagent such as Ca(OH)₂ which ppts. a mixt. of org. and inorg. substances. The resulting product, without filtration, is further agitated and aerated to remove pptd. org. matter substantially free from inorg. matter, as a froth. The pptd. inorg. matter is afterward sepd.

Nitrocellulose. V. PLANCHON. *Brit.* 230,092, Feb. 29, 1924. Thick sheets of wood pulp of low porosity are subjected for several hrs. to the action of nitrating acids at a temp. of 5-15° and may be held vertically in the same portable supporting racks during nitration and subsequent stabilization and washing treatment, etc.

Paper-making apparatus. S. MILNE. *Brit.* 230,170, Dec. 5, 1923.

Paper-making machine. A. DANNINGER. *Brit.* 230,086, March 1, 1924.

24—EXPLOSIVES AND EXPLOSIONS

CHARLES E. MUNKOE

Explosives in 1914-1923. ALFRED STETTBACHER. *Chem.-Ztg.* 49, 621-2, 642, 646-7, 666-7, 682-4, 713-6, 729-32, 737-40(1925). E. H.

The preparation of tetranitromethane from nitroaromatic hydrocarbons. PHYLLIS V. MCKIE. *J. Soc. Chem. Ind.* 44, 430-1T(1925).—A study of Classen's method for the prepn. of explosive C(NO₂)₄ for use in munitions in which the effects of the ratios of SO₃, of oleum and of HNO₃ to the nitrohydrocarbon, on the yields were noted. Of the nitrohydrocarbons used C₆H₅NO₂, C₁₀H₇NO₂ and C₆H₄(NO₂)₂ were the most fertile in yields but the last afforded the most economical production. The yield on the

HNO_3 is low, but by high concns. of SO_3 a large proportion of the HNO_3 may be held back in the residue from the distn. of the $\text{C}(\text{NO}_2)_4$. This spent acid serves well for diacid tri-nitrations but not for mono-nitrations.

CHARLES H. MUNROE

Use of liquid air in mine explosives and for welding and cutting metals. HERPIN. *Rev. métal.* 22, 521-6(1925).—Discussion of the merits of the Weper cartridge (cellulose, Al powder, liquid O), and of the advantages of liquid over compressed O for cutting and welding.

A. PAPINEAU-COUTURE

Apparatus for the determination of methane or other hydrocarbons in the air, with special reference to mines. RUDOLPH WINKLER. *Colliery Guardian* 130, 146(1925).—An app. is described and illustrated in which annealed wires are brought to different temps. by CH_4 burning catalytically on 1 annealed wire while the other wire is wholly insulated downwards. On the wires are thermoclements inserted against one another and their elec. powers balanced as indicated by a galvanometer. The wires are set in glass bulbs. The wire which is completely shut off from the outside may at the same time serve for illumination, the different lighting effects of the 2 wires also indicating the presence of CH_4 . The whole app. is in the form of a miner's lamp. C. C. D.

The ignition of firedamp. H. F. COWARD AND R. V. WHEELER. *Colliery Guardian* 130, 264-5, 323, 378-9(1925).—Mixts. of CH_4 and air of suitable compn. take fire when a sufficient vol. is maintained at a high enough temp. for a long enough time, the 3 factors being mutually dependent. Thus a large vol. of highly explosive mixt. may be raised to its ignition point and yet not take fire if it is again cooled rapidly, but 0.000001 sec. suffices for an elec. spark of ordinary intensity to ignite a local portion of the mixt. so that a flame is propagated throughout. If the source of heat is less intense the induction time is longer but it eventually compensates for the lower temp. A mixt. of CH_4 and air may remain at its ignition point even 10 sec. and then suddenly take fire. All means of ignition should be regarded as sources of heat for a definite time regardless of whether this heat is supplied to the individual gases before they are mixed, whether the heat originates in mech. work such as compression or whether the heat is supplied by a flame or a spark. The means of ignition det. what mixt. of air and CH_4 is most easily ignited. When contact with the source of heat is of long duration, mixts. contg. 5-7% CH_4 can be ignited at the lowest temps. The lag before ignition, however high the temp. of the source of heat, is shortest with mixts. contg. the smallest proportions of CH_4 . When mixts. are heated by sudden compression, those contg. 6.5-8% CH_4 ignite at the lowest temps. When the source is a heated wire, all mixts. which are inflammable at all are almost equally easy to ignite, though there is a slight tendency for 5-7% CH_4 mixts. to ignite most readily. The relative ease of ignition by the aid of friction sparks is still uncertain. With elec. sparks of any type mixts. contg. 8-9% CH_4 ignite most readily, with a gas flame of short duration 10% CH_4 mixts. ignite most readily and with a flame from explosives a 9% mixt. Any ordinary sustained flame, e. g., a lamp, ignites all inflammable CH_4 -air mixts., but heated surfaces are less dangerous unless their temp. is unusually high. Since the surface area is the predominant factor in detg. the time the mixt. remains heated without firing, a material with a large surface is more dangerous than a wire at the same temp. A wire is in turn more dangerous than a friction spark of equal temp. Elec. sparks are the more dangerous the more rapidly their energy is communicated to the inflammable mixt., so that capacity sparks are more dangerous than inductance sparks of equal energy. The character of the current, whether a.c. or d.c., does not influence materially the incendiary of the inductance sparks. C. C. DAVIS

Firedamp explosions within closed vessels. The effects of turbulence. G. B. MAXWELL AND R. V. WHEELER. *Colliery Guardian* 130, 323(1925).—Expts. were made with mixts. of CH_4 and air in a spherical vessel to det. (1) the max. pressures developed by any mixt. of CH_4 and air on ignition, either when quiescent or turbulent and (2) the rate of development of this pressure. Though considerably higher pressures could be obtained from weak mixts. when they were turbulent, the most explosive mixts. (9-10% CH_4) were not greatly influenced even by extreme turbulence. The max. pressure of any quiescent mixt. initially at atm. pressure was 105-10 lbs. per sq. in., turbulence increasing this about 4%. But both with weak and strong mixts., turbulence greatly increased the rapidity with which this max. pressure was reached. Neither the slight increase in max. pressure from turbulent mixts. nor the greatly increased rapidity of its development had any effect upon the safety of "flange protection" devices for flameproof mining elec. app. C. C. DAVIS

Tests of internal relighters. G. B. M. PLATT. *Colliery Guardian* 129, 1565(1925).—Premier no. 7 and 11 and Wolf safety lamps with 20- and 28-mesh gauzes were tested with explosive mixts. of pentane and air and CH_4 and air to det. their danger

when relighted. Expts. were also made in which pyrophoric particles (prepd. by the prolonged operation of an igniter in an inert atm.) were brought in contact with the hot gauze of a lighted lamp in an atm. contg. 8-9% CH_4 . Ignition of the external atm. occurred (1) when the gauze was at least 260° ; (2) when before treating the gauze with the particles the light was extinguished; and (3) when the particles fell into the gauze in a mass. No alloy should be used the particles from which have an ignition temp. below 300° .

C. C. DAVIS

Explosion of a power-station superheater. G. J. ISAAC. *Engineering* 120, 225 (1925).—The superheaters were fitted between turbine machinery and boilers but ~~not~~ separately. The damaged unit was composed of 27 groups of tubes, each group having U-shaped tubes 35 ft. 4 in. in length, each made of solid drawn mild steel 1.5 in. internal diam. and corresponding to No. 9 Gage in thickness. They were erected in place in 1908. The orders were for the temp. of the superheated steam to be maintained at $500-600^\circ\text{F}$. 45 min. before the explosion 7 boilers were generating steam at 100 lb. pressure. Only 1 superheater was in operation and the temp. of its steam was about 400°F . A second superheater was then connected up and it was in this that the explosion occurred. Inspection showed that but 1 tube had been burst. It was the one directly in the path of the exit from the muffle chamber and therefore of the gases at their highest temp. It had increased in external diam. to $1\frac{1}{4}$ in. over a length of about 2 ft. above and 3 ft. below the fracture. Its thickness had been to 14 Gage at a distance of about 3 in. from the ends of the fracture and, at the point of fracture, to 19 Gage. The inside surface of the tube was coated with a black oxide of Fe scale about $\frac{1}{32}$ in. in thickness. Conclusion: Deterioration was due to the action of superheated steam on the material of the tube when subjected to comparatively high temps. over a considerable period of time.

CHARLES E. MUNROE

The explosion at Bodio. E. BERL. *Z. angew. Chem.* 38, 679-80 (1925).—Controversial with Schaarschmidt. Cf. *C. A.* 17, 2959; 18, 2429; 19, 2879. E. M. S.

The decomposition of liquid hydrocyanic acid. MARK WALKER AND D. N. ELDRED. *Ind. Eng. Chem.* 17, 1074-81 (1925).—A study of the causes of recent explosions of tanks of liquid HCN. Known amts. of liquid HCN were heated in steel bombs under definite conditions. Time-temp. and time-pressure curves were obtained as well as the compn. of the reaction products, in the presence of stabilizers and catalyzers. Explosions of HCN were found to be due to the formation of gases, which, in their turn were caused by the exothermic polymerization and decompn. of the liquid. At ordinary temp. polymerization of the HCN, with or without a sudden rise of pressure, may result from the balance between the heat of decompn. and the loss of heat by radiation. The products of the reaction were a solid black mass which is a polymer of HCN, and several gases, in which NH_3 and CO predominated. Gas mixts. of HCN and air of 11% by weight of HCN will explode when ignited. It is concluded, however, that the explosions are not due to a spontaneous rupture of the HCN mol. but rather to the pressure of the gases formed by the hydrolytic decompn. of the liquid HCN.

J. H. P.

Screening smokes. H. W. WALKER. *Ind. Eng. Chem.* 17, 1061-5 (1925).—An illustrated account dealing with the history and the definition and properties of smoke screens and tracing of cloud travel, properties of ideal smoke-producing material, methods of smoke generation, present materials considered for screening smokes, tactical use of smoke, air-plane possibilities and naval possibilities. Crude oil, oleum and P will give max. obscuring power at min. cost in the order named but, for a given wt. of material, in the reverse order. From consideration of all the factors involved they will be the 3 smoke agents in general use except in the case of air-plane distributions.

CHARLES E. MUNROE

The movement of flame in closed vessels (ELLIS, WHEELER) 2.

Explosive. G. GLOFF. U. S. 1,551,650, Sept. 1. A hydrocarbon gas such as C_2H_4 , CH_4 or casing-head gas is maintained in liquid form under pressure together with an oxidizing agent such as O_2 or ozone or a nitrate to form an explosive.

Nitrocellulose explosives. T. J. NOLAN, N. PICTON and NOBEL'S EXPLOSIVES LTD. Brit. 229,614, Aug. 10, 1923. The amt. of solvent required in making nitrocellulose propellant explosives with volatile solvents is reduced by a preliminary heating of the nitrocellulose used, with H_2O , to above 100° , with or without addn. of acids,

alkalies or salts to the H_2O . Brit. 229,615 specifies explosives contg. nitroglycerin and nitrocellulose which has been similarly treated.

25—DYES AND TEXTILE CHEMISTRY

L. A. OLNEY

Recent progress in the chemistry of organic coloring materials. P. CASTAN. *Arch. sci. phys. nat.* [5], 7, 196-204(1925).—The *neolane dyes* are azo derivs. of β -naphthol, which with Cr mordants yield brilliant blue, green and black colo. The *ionamine dyes*, developed for use on cellulose acetate, consist of a secondary amine condensed with $NaHSO_3$ and CH_2O , and coupled with a diazonium salt. The *duranol dyes* are derivs. of chloro- or bromoanthraquinone condensed with anthranilic acid. *Indigosol O*, prepd. by the action of $ClSO_3H$ on leucoindigo in pyridine soln., is the H_2SO_4 ester of leucoindigo, and regenerates indigo by the action of oxidizing agents. T. S. CARSWELL

Kinetics of photochemical processes in dyes. A. PRÉVODITELEV AND N. NETCHAEV. *Z. Physik* 32, 226-35(1925).—The initial rates of the bleaching of cyanine and pinacyanol in collodion show a periodicity which is dependent on concn. This does not apply if the solns. are sufficiently dil., for which the rate of bleaching is in accordance with the formula for a unimol. reaction. B. C. A.

Another water-soluble vat dye—Soledon Jade Green of the anthraquinone series. C. H. MULLIN. *Textile Colorist* 47, 568-71(1925).—A discussion of the vat dyes and the manuf. of the sol. vat dyes according to the patent literature and of the application of Soledon Jade Green and its advantages. CHAS. F. MULLIN

Indanthrene blue reserves. JOS. POKORNÝ. *Textilber.* 6, 510(1925).—P. defends his priority in the use of $MnCl_2$ for the purpose. E. R. C.

Action of chromic acid on indigo. L. EYMER. *Rev. gen. mat. color.* 29, 225-6(1925).—The very rapid discharge of indigo by CrO_3 in the presence of $H_2C_2O_4$, takes place because oxalic acid is the only org. acid at present known, which reduces CrO_3 energetically in the cold, with the intermediate production of $Cr_2O_3 \cdot CrO_3$ and the evolution of ozone. L. W. RIGGS

Colloid chemistry and dyeing. GEORGE WALTER. *Textilber.* 6, 592-6(1925).—A review, particularly of the work of Pauli, with references. E. R. CLARK

The dyeing process. HALLER. *Textilber.* 6, 669-73(1925).—By applying pressure to the liquid in which dyed particles are cooked, the dye is caused to condense into comparatively widely distributed particles easily visible under the microscope. Photomicrographs are given. The expts. show that dyed fabrics are labile systems. E. R. CLARK

Dyebaths as disperse systems. NOWAK. *Textilber.* 6, 427-31, 503-6, 589-90(1925).—This address attempts to explain many phenomena of dyeing on the basis of colloid theory and to show that certain B. A. S. F. preps. for addn. to dyebaths have a scientific purpose. Research on the crystal structure of cotton should aid in establishing an optimum dispersion for fast dyeing, and this may eventually be predetd. At present, such dispersion is attained fortuitously, many methods having been discovered empirically. The B. A. S. F. has succeeded in making true dyeings with insol. materials even on acetate silk by attaining proper dispersion. Dyebath addns. which alter the degree of dispersion may also affect the elec. charge of the colloidal dye particles, and there apparently is an optimum dyeing potential. The attaining of this desired potential is the real purpose of electrolyte addn. rather than the salting out effect. In vat dyeing, high dispersion of the dye is induced by sparing $NaOH$, and the negative charge of the dye suspension may be reduced by electrolytes. As these conditions do not favor level even dyeing a protective colloid such as "Dekol" may be used to advantage. This prepn. stabilizes the suspension against the electrolytes of certain reserves also. Pyridine bases such as "Tetracarnit" exert a strong dispersing action on vat dyes. The action of metal salts depends on the character of the hydrate formed with $NaOH$. The hydroxides of Mn, Fe, and to less extent of Al and Zn, in low concns. act as protective colloids. E. R. CLARK

Dyeing of artificial silks. L. G. LAURIE. *J. Soc. Dyers' Colourists* 11, 305-8(1925).—Details for the handling of many dyes and the different varieties of artificial silks are given. L. W. RIGGS

Dyeing of artificial silk from cellulose acetate. P. CASTAN. *Mon. sci.* 15, 145-8

(1925).—Cellulose acetate silk may be dyed with ordinary dyes by working in an alk. bath, which hydrolyzes the exterior of the silk and gives it an affinity for the dyestuff. Another procedure is to dye in the presence of mutual solvents of the silk and dye, such as acetin or pyridine. A third process is to dye with colloidal solns. of insol. dyes, a protective colloid being used. A fourth procedure employs dyestuffs which have a special affinity for the fiber, such as the *ionamine* or *duranol* dyes. The chem. formulas and methods of application are given for a no. of the latter.

Dyeing and mercerization. W. J. WILSON. *Textile Colorist* 47, 510(1925).—The dyeing of mercerized cotton and the mercerization of cotton consisting in part of ~~the~~ ^{the} ~~ad-~~ ^{ad-} ~~dress-~~ ^{dress-} are discussed.

Dyeing of cotton and silk hosiery. S. V. DE FOREST. *Chemicals* 24, No. 11, 17 (1925).—General.

Adhesives in dyeing cotton and in making it waterproof. W. B. NELSON. *Am. Dyestuff Rept.* 14, 685-7(1925).—The topics considered are: the nature of fabrics in which adhesives are employed, a machine for adhesive application, a formula for an adhesive paste, the use of casein as an adhesive, and the use of Al acetate for waterproofing.

Loose-wool dyeing. L. J. MATOS. *Textile World* 68, 1164; *Dyestuffs* 26, 109-11 (1925); cf. *C. A.* 18, 473.—General.

The use of protective agents in cross-dyeing of union goods with sulfur dyes. W. J. SAYERS. *Textile Colorist* 47, 491-3(1925).—Glucose, fructose, lactose, maltose, sulfate waste liquors or their active components, Na ligninsulfonate, cell pitch, etc., have been used as protective agents in applying S dyes to silk and wool. Usually a large quantity of the protective agent tends to prevent the dye from going on the wool or silk and this fact is used in cross-dyeing unions, to leave the wool or silk nearly white while dyeing the cotton. S. obtained the best results with 20% of dye (Immedial Direct Blue B), 30% of glue in soln., Na₂S 20%, Na₂SO₄ 40% and Na₂CO₃ 5%, at room temp. in a 20 to 1 dye-bath for 15 min. Other expts. are given.

Velour hat dyeing. JACK SCHWEIG. *Textilber.* 6, 581-3(1925).—Recipes with samples.

The newest wrinkles in dyeing cotton. J. M. MATTHEWS. *Chemicals* 24, No. 3, 17-9(1925); cf. *C. A.* 19, 2748.—The new naphthols, indigosol, katanol, tamol and the use of Cr-mordant dyes on cotton are discussed.

Action of mordants on various fibers. M. N. CONKLIN. *Chemicals* 24, No. 3, 19-20(1925).—General.

Mercerizing with nitric acid. P. P. BUDNIKOV. *Textilber.* 6, 661-2(1925).—Cotton treated with 40-41° Bé. HNO₃ loses 10% in length and gains 20% in strength. The most favorable temp. is 15-26°. Although a few seconds' immersion ordinarily suffices, the affinity for acid increases with longer immersion.

Recent processes of altering the character of cotton. ANON. *Chemicals* 24, No. 11, 31*2(1925).—A discussion of the various patents covering the use of H₂SO₄ and HNO₃ on cotton.

Quantitative estimation of the reducing power of cotton before and after various treatments. HELMUT KORTÉ. *Textilber.* 6, 663-4(1925).—Neither the Cu no. of Schwalbe or Brajdy, nor the KMnO₄ no. of Kaufmann, suffices without tensile tests to show the freedom from tendering of cotton goods.

Is mercerization of cotton accompanied by a chemical change of the material? KURT HESS. *Z. Elektrochem.* 31, 316-9(1925).—According to X-ray observations made by Herzog (*C. A.* 18, 2073) and Katz and Mark (*C. A.* 19, 1773) a small irreversible change in lattice structure after mercerization of cotton is due to some chem. process in the fiber (hydration or different ring structure). A similar change is brought about by HNO₃, not by HCl or H₂SO₄. H. (cf. *C. A.* 18, 1384; 19, 1196) on the basis of chem. evidence attributes this phenomenon to a mere ionization effect of the alkalis and of HNO₃ on the amphoteric C₆H₁₀O₅ units, which causes these units to change their orientation in the fiber lattice, a structural change of C₆H₁₀O₅ is unlikely.

"Woolenizing" cotton fabrics. W. KIND. *Textilber.* 6, 661(1925).—The Philana process will not achieve the popularity of mercerizing as it makes the product poorly resistant to bleaching, dyeing and washing. Tests made on an equal thread basis show that the cotton is actually tendered. (A reply by the Philana Co. states that equal thread basis has no meaning to the consumer, and that they could not confirm K.'s tests on the poor resistance to after-treatments.)

E. R. CLARK

Allwörden's reaction. W. SPÖTTEL, *Textilber.* 6, 805(1925).—The phenomena exhibited by chlorinated wool are explained by changes in the superficial scales.

E. R. CLARK

Artificial silk, with special reference to the viscose process. M. G. LUFT. *Ind. Eng. Chem.* 17, 1037-42(1925).—A history of artificial silk, a short description of cuprammonium, nitro and acetate silks, and a much longer description of viscose and its manuf. are given.

L. W. RIGGS

The weighting of silk piece goods. JAMES CHITTICK. *Textile World* 68, 1043-5 (1925).—A general comparison of the results obtained by yarn weighting and piece-goods weighting.

CHAS. F. MULLIN

Improving the light resistance of silk. KARL HOMOLKA. *Textilber.* 6, 584-5 (1925).—Urca, hydroquinol, tannin, catechu and tannin-Sb are all effective in protecting silk against ultra-violet light. Tannin alone worked best. The Hg quartz lamp gave effects similar to outdoor exposure.

E. R. CLARK

The ripening of viscose. GEORGE DE WYSS. *Ind. Eng. Chem.* 17, 1043-5(1925).—The conclusion that a chem. change takes place during the ripening of viscose has recently been put in doubt by Leuchs and by Herzog. Leuchs's method of analysis is erroneous. A modification of it gives the true amt. of xanthate S in viscose. Several viscoses analyzed when fresh and during the ripening showed a distinct decrease in the amt. of xanthate S, the proportion of S to cellulose falling more than 50% during 160 hrs. The changes in the compn. of the cellulose xanthate mol. during ripening are paralleled by the changes in the ease of coagulation of the viscose.

L. W. RIGGS

Ripening of viscose from the colloid viewpoint. RUD. BERNHARDT. *Kunstseide* 1, 169-74(1925).—Viscose solns. examd. with ultra-filters show when fresh a degree of dispersion similar to that of Congo red, and the dispersion decreases with aging. The cloudiness of viscose is due to suspension of CS_2 .

E. R. CLARK

Physical data on different sorts of rayon. KURT GÖTZE. *Textilber.* 6, 664-5 (1925).—Current products of German manuf. are as good or better than other makes in tensile strength.

E. R. CLARK

Ratio of yarn size to fabric weight. R. PRESGRAVE. *Textile World* 68, 1035-9, 1047(1925).—A study of silk tricot and milanese fabrics.

CHAS. E. MULLIN

Modern bleaching problems. GUSTAV ULLMANN. *Textilber.* 6, 508-10(1925).—Kiers should be improved so that cooking time could be reduced. Tunnel drying methods should supplant cans and tenters. The Mohr cold bleach is attracting attention.

E. R. CLARK

Bleaching experiments on various types of flax. G. KRANZLIN. *Faserforschung* 4, 200-12(1924).—For comparable bleaching, quant. expts. showed that water-retted blue flax from Holland destroyed some 30% more active Cl than a standard type of warm-water vat-retted German flax, primarily because it contained more lignin. The color and type of retting of flax seem to have little influence on the ease of bleaching; this is really closely connected with the climate, weather and soil conditions under which the flax is grown.

E. R. CLARK

Dyes. FARBENFABRIKEN VORM F. BAYER & Co. Brit. 230,055, Feb. 28, 1924. Azo dyes which dye wool blue or violet shades are made by coupling diazotized dinitroanilines contg. a substituent acid group with sulfonic or carboxylic acids of 2-naphthylamine or its derivs. Cf. C. A. 19, 1632.



Vat dyes. K. SCHIRMACHER and W. ECKERT. U. S. 1551,849, Sept. 1. Oxidation products of dibenzanthrone, dimethyldibenzanthrone or other vat dyes contg. a perylene nucleus are treated with $ZnCl_2$, $AlCl_3$ or other metallic chlorides capable of acting as dehydrating or condensing agents when heated and the products thus formed are allowed to obtain dyes which generally produce fast blue dyeings.

Vat dyes. A. ZINKE. Can. 253,122, Aug. 25, 1925. Perylene and benzoyl derivs. are condensed by anhyd. $AlCl_3$ in the heat and the reaction product is purified.

Perylene vat dyes. A. ZINKE and H. SCHÖPFER. Can. 252,230, July 28, 1925. Perylene quinone suspended in nitrobenzene is treated with Cl until soln. takes place and the soln. is boiled with aniline.

Anthraquinone derivatives. E. G. BECKETT, J. THOMAS and F. COTTISH DYES, LTD. Brit. 230,116, Sept. 3, 1923. The 1-phthalimidoanthraquinone described in Brit. 214,765 (C. A. 18, 2715) is nitrated in concd. H_2SO_4 soln., the product is hydrolyzed in dil. H_2SO_4 soln. and the resulting dinitroaminoanthraquinone reduced by Na sulfide to a

triaminoanthraquinone which dyes cellulose acetate purple shades from an aq. suspension. Benzoylation of the triamino compd. gives a product which dyes cotton bluish red shades from a hyposulfite vat.

Dyeing. A. ESCAICH and J. P. WORMS. Brit. 230,128, Oct. 22, 1923. Animal and vegetable fibers, feathers, furs, hairs, leather, artificial silks, wood, gelatin and other materials are dyed or printed with phenols or phenolic derivs. such as salicylic acid, dinitroresorcinol or salicylaldehyde, applied either with or without heating, with nitrates or HNO_2 in the presence of metallic salts or oxides such as those of Cu, Ag, Au, Zn, Ba, Hg, Al, Sn, Pb, As, Sb, Cr, Mo, W, U, Mn, Fe, Ni, Co or Pt. Aniline or other amines may be used as starting materials instead of the phenols, but in such case sufficiently high temps. must be used to form the corresponding phenol. Numerous examples are given, involving production of a large variety of colors. Cf. C. A. 18, 812.

Artificial silk. J. S. WILSON, J. THOMAS and SCOTTISH DYES, LTD. Brit. 230,130, Dec. 20, 1923. Natural silk is dyed with an aq. soln. of suspension of 1-methylamino-, 2-methyl-, 2-amino-, 1,4-diamino-, 1-methylamino-4-amino-, or triaminoanthraquinone. 1-Methylaminoanthraquinone produces a bluish red dyeing. Mixed with 20% contg. silk may be similarly dyed.

Dyeing apparatus. J. LRYGOW. Brit. 230,119, May 22, 1924. Rollers for dyeing app. are formed of port. cement and granite chips and may also contain reinforcing devices.

Apparatus for dyeing yarn, etc. A. ASHWORTH. Brit. 230,300, Apr. 22, 1924.

Apparatus for bleaching, dyeing or other treatment of yarns wound in "cheeses." JOHN THOMAS and JOSEPH BRANDWOOD. U. S. 1,551,866, Sept. 1.

Apparatus for coating and drying textile materials. P. S. SMITH. U. S. 1,551,913, Sept. 1.

Artificial silk from acetylcellulose. E. BINDSCHEDLER and G. JUER. U. S. 1,551,791, Sept. 1. Clear unclouded products are obtained from acetylcellulose or its homologs by dissolving the cellulose esters with acetone or a homolog, and, after forming, extg. the solvent by immersing the formed product in a concd. soln. of CaCl_2 .

Treating artificial silk. W. S. GILLES, E. TEMPLETON, E. SMITH and COURTAULDS, LTD. Brit. 230,187, Dec. 7, 1923. "Viscose silk," "cuprammonium silk" and "nitrocellulose silk" are treated with a sizing such as gelatin, albumin or starch and then with a caustic alkali soln. of a strength of at least 18% and subsequently with dil. acid rapidly to remove the alkali. This gives the product an appearance more nearly like that of natural silk than before the treatment.

Electric vibration apparatus for testing textile threads. Soc. CHIMIQUE DES USINES DU RHONE. Brit. 230,463, March 4, 1924.

Apparatus for printing yarns and threads. A. ROBINSON and BRITISH COTTON AND WOOL DYERS' ASSOCIATION, LTD. Brit. 230,280, March 24, 1924.

26—PAINTS, VARNISHES AND RESINS

A. H. SABIN

Modern developments in paint manufacture. J. G. BEARN. *Chem. Age* (London) 13, 188-90, 221-3 (1925). E. J. C.

Anti-rust paints. PFLÜGER. *Farbe u. Lack* 24, 525-6 (1924); *Chimie et industrie* 14, 270.—The purpose of these paints is to protect the metal by means of a coating as waterproof as possible. This seems to be particularly well attained by using a paint with a basic Pb oxide pigment, which is gradually converted into metallic Pb, thereby forming an impermeable and stable coating. A. PAPIEAU-COUTURE

Mechanism of the manufacture of oil varnishes. SCHEIBER. *Farbe u. Lack* 25, 16-9 (1925); *Chimie et industrie* 14, 271.—Variations in the acid no. and mol. wt. of oils and gums used in varnish making when heated at 280° for various lengths of time were detd. both for the individual substances and for oil-gum mixts. The results obtained from mixts. were appreciably different from those calcd. from the constns. of the sep. constituents, and S. concludes that there is a reaction between the substances. A. PAPIEAU-COUTURE

The bakelite content of the alcohol vapors rising from bakelite varnish during drying.

H. V. D. HEYDEN AND K. TYPKE. *Elektrotechn. Z.* **46**, 624(1925).—Two tests made with solns. of equal parts by wt. of bakelite and alc. showed the vapors contained 15 and 16%, resp., of bakelite.

C. G. F.

Colloid chemistry of color varnish. II. Pitting, seeding, silting and surface dulling. F. E. BARTELL AND M. VAN LOO. *Ind. Eng. Chem.* **17**, 1051-8(1925).—Various defects observed in color varnish films are discussed from the view point of the vortex ring action (cf. C. A. **19**, 3026). Pitting arises from high interfacial tension between the varnish and the surface to which it is applied; from the repulsion of the varnish body from nuclei pptd. from the oil body, with the same elec. charge; and from the vortex action which may leave the centers of the cells as open pores in the films. Seeding is due to the accumulation of the pigment on immiscible solids suspended in the oil; to insufficient wetting of the pigment by the oil body; and to vortex action, which piles up the denser or larger particles at the centers or corners of the cells. Sighting results from the regular alignment of cells in the varnish film coupled with the same vortex action which causes seeding. Surface dulling is due to the interference of light from the uneven-celled surface of the film, the accumulation of the pigment or other immiscible phase at the air interface, and the addn. of H_2O to the mixed varnishes.

F. A. WERTZ

Effect of heat treatment on drying of tung oil. D. DAVIDSON. *Paint, Oil and Chem. Rev.* **80**, No. 8, 10(1925).—D. believes that the speed of drying of all rosin varnishes varies inversely with the temp. applied, but the results obtained on exptl. lab. batches do not strictly agree with this. The decompn. products liberated when the oil is heated to 500° F. diminish its drying power, and account for the fact that tung oil does not gelatinize when heated very rapidly to about 605° F.

F. A. WERTZ

The chemistry of drying oils. I. G. W. ELLIS. *J. Soc. Chem. Ind.* **44**, 01-8T(1925).—A review of earlier work on the compn. of linoxyn justifies the hypothesis that it is a mixed glyceride composed of 1 linolenic acid radical to 2 linolic acid radicals autoxidized by the addn. of 7 mols. of O to $C_{37}H_{64}O_{20}$. Attempts to obtain pure linoxyn of definite compn. by exn. with various single and mixed solvents were unsuccessful. A mixt. of EtOH 15% and CCl_4 85% was the most effective solvent found, but if linoxyn is a compd., it is apparently capable of being converted into an isomeric or perhaps a depolymerized form by the action of solvents. When linseed oil is exposed for 5 or 6 days in very thin films, a linoxyn in all probability of the most highly autoxidized form results. This linoxyn was purified by saponifying with 5% soln. of NaOH and then filtering and washing the residue with the same soln. The residue consisted of soaps of the satd. fatty acids present, and yielded purified fatty acids consisting principally of stearic and palmitic acids, to an av. of 3.94% of the linoxyn taken. Since linseed oil contains a much higher percentage of satd. acids, it is probable that the removed acids are a residual impurity and not a constituent of the autoxidized product. When proper correction is made in the ultimate analysis of the original linoxyn, for the satd. acids and for the ash present, the compn. of the linoxyn comes within exptl. error of that required by the formula proposed above. The I value of the linoxyn decreases as the O content increases and appears to attain a min. which would represent at least one remaining unsatd. bond in the formula. The ultimate analyses of linoxyn produced in the various expts. are tabulated.

F. A. WERTZ

Arsenic in shellac. R. V. BRIGGS. *Oil, Paint & Drug Rep.* **108**, No. 2, 80(1925).—Excessive As in shellac often raises the I no. to a point higher than that allowed for pure shellac, and thereby gives a misleading indication of the amt. of rosin present.

F. A. WERTZ

Resins for lacquers and their solvents. GEORGE H. LINCKS. *Paint, Oil and Chem. Rev.* **80**, No. 10, 16-7, 21(1925).—A review of the m. p., acid nos., and solubilities of the gums most generally used in lacquers; with some suggested lacquer formulas.

F. A. WERTZ

The fire hazard of lacquer. M. J. MISKELLA. *Paint, Oil & Chem. Rev.* **80**, No. 10, 18-20(1925).

E. J. C.

Artificial resins and plastic substances. A. C. HOPPER. *Chem. Age* (London) **13**, 270-2(1925).—A review.

E. H.

Aging of synthetic resin molded products. E. J. CASSELMAN. *Chem. Met. Eng.* **32**, 682-3(1925).—The reactions taking place during the formation of phenol-aldehyde condensation resins are briefly discussed. The aging of the finished resin and of fibrous materials impregnated with it, consist largely in the gradual evapn. of volatile residual impurities such as NH_3 , H_2O and alc.; this tends to improve the elec. properties and to increase the hardness of the resin.

F. A. WERTZ

Survey of the turpentine industry for possible larvicidal substances (BARNES)

15. Consistency of suspensions particularly of artists colors (v. DEURS, RAASCHOU)
2.

White lead from crude ore. A. G. CAMPBELL. U. S. 1,551,536, Sept. 1. The Ag and Pb values in crude ore or concentrates are first chloridized and leached with an alkali metal chloride soln. The soln. thus obtained is purified, and the Pb is pptd. as hydrated carbonate by addn. of alkali metal hydroxide and agitation with a stream of CO_2 .

Automobile top dressing. H. S. CUTLER. U. S. 1,551,803, Sept. 1. Mutton tallow 100 lbs., castor oil 5 gals., neat's foot oil 5 gals., lampblack $7\frac{1}{2}$ lbs., beeswax 5 lbs., Burgundy pitch 1 lb., resin 1 lb., flax 100 lbs., salicylic acid 1 oz., oil of citronella 20 oz. and varnish 1 qt.

Resin. W. O. HERRMANN, H. DEUTSCH and W. H. HALHNEL. Can. 249,338, May 4, 1925. Non-phenolic resins are treated with org. hydroxy acid compds., the hydroxy acid compds. being added in any stage of the process of producing the aldehyde resins.

Epoxy resin. H. W. MATHESON and J. A. NIEUWLAND. Can. 250,295, June 2, 1924. H_2F_2 is passed into a phenolic substance contg. H_2SO_4 and a salt of Hg at a temp. c. $0-150^\circ$.

Transfer ink. T. MARSTON and W. S. LAWRENCE. Brit. 230,275, March 18, 1924. A transfer ink for application by heat to fabrics is formed by incorporating a basic dye (e. g., a dye with an induline or nigrosine base) in stearic, oleic, lauric or myristic acid or other acid medium from which the dye can be sepd. by treatment with a base, soap or other alk. soln. Cf. C. A. 19, 185.

27—FATS, FATTY OILS, WAXES AND SOAPS

E. SCHERUBEL

The preparation and refining of olive oil in southern Europe. W. V. CRUESS. California Agr. Expt. Sta., *Circ.* 279, 1-43(1924); *Botan. Abstracts* 14, 561. H. G.

The sulfuric index of cottonseed oil and in admixtures with olive oil. J. K. MORTON AND G. C. SPENCER. *J. Oil and Fat Ind.* 1, 66-71(1924); *Expt. Sta. Record* 52, 411.—A study is reported of the value of the H_2SO_4 index of Mazzaron (C. A. 10, 2534) as a means of the identification of simple oils or of the constituent oils in mixts. The test depends upon the reaction of the oil with H_2SO_4 with the formation of a gas, chiefly SO_2 , which is let into a standard I soln. and detd. by titration of the excess I with standard $\text{Na}_2\text{S}_2\text{O}_3$. The no. of cc. of 0.1 N I consumed is the H_2SO_4 index of the oil. The app. for the detn. is described and illustrated, and the technic of the process is given in detail. Data are reported on the max., min., and av. values obtained in several detns. with a no. of samples of refined cottonseed oil from different localities, with mixts. of cottonseed oil and olive oil, and with various other oils. The min. and max. values reported for genuine cottonseed oil were 56.1 for a sample of cooking oil from North Carolina and 92.7 for Tennessee prime summer yellow cottonseed oil. Indices reported for other oils were California olive oil 2.1, 2.54, 2.6 and 2.2, Italian oil 1 and 1.21, tea-seed oil 1.62, coconut oil 0.8, sesame oil 52.67 and 51.97, apricot oil 15.1 and 14.3, cold-pressed peanut oil 5.73 and sunflower-seed oil 138.1. In mixts. of olive and cottonseed oil the H_2SO_4 index was not proportional to the quantity of either oil present. Olive oil with addns. of cottonseed up to 25% showed only a slight increase in the H_2SO_4 index, while cottonseed oil with 10% of olive oil showed a marked decrease in the index. Conclusion: As a routine method it does not compare with the I no. but it does compare favorably with this as a means of identification of an unadulterated oil. It is emphasized that the conditions of the detn. must be carefully controlled if the results are to be of value.

Studies on the oil and ammonia content of cottonseed. Progress report on basic research problem. I. A. F. SIEVERS. *J. Oil and Fat Ind.* 1, 56-61(1924); *Expt. Sta. Record* 52, 410.1.—Twenty-nine samples from different localities were analyzed. For uniformity of results the oil detns. were made on the seed delinted with H_2SO_4 , dried and extd. with petr. ether. The 29 varieties could be placed in 3 groups, including 9 with high, 11 with medium and 9 with low oil content. The av. content of oil in the

seeds of the low-oil group was 22.43 and of the high-oil group 24.31%. The highest oil content of any of the samples was 31.74% and the lowest 15.29%. The variety giving the largest amt. yielded only 16.01% at another station, while the one giving the smallest quantity yielded 28.68% at another station. In general, however, the high- and low-yielding varieties fell into the same groups at the different stations. The seeds in the high-oil group contained 3% more kernel than those in the low-oil group. In all cases where the different varieties at the same station all produced plump and fully matured seed, the kernels of the seed in the high-oil group had a distinctly higher oil content than those in the low-oil group. The av. wt. of the seed was only slightly higher for the low-oil than for the high-oil group. The NH_3 detns. were made on the whole seed, and the percentages calcd. on this basis as well as on the delinted-seed basis. The percentages of NH_3 did not show any marked varietal relationship, but in the same variety seed which in some localities had a high and in others a low oil content tended to have low and high contents of NH_3 , resp. It is emphasized in conclusion that climatic conditions are of great importance in regard to the yield of oil from cotton seed. The seed yielding the best oil was from one of the irrigated stations not depending upon natural rainfall.

H. G.

Properties of cacao butter. HEINRICH FINCKE. *Z. angew. Chem.* **38**, 699-701 (1925).—Twelve samples were examd. Some were obtained by pressing, some by extrn. The cacao beans were variously treated (some roasted, some not, some just dried, etc.) and in some instances contained various amts. of shells, other beans or seed buds. The properties detd. were m. p., m. p. of fatty acids, acid no., I no., sapon. no. and η .

E. SCHERUBEL

Oil from raisin seed. R. CHAVASTELON. *Compt. rend. agr. Franc.* **11**, 592-4 (1925).—A complete chem. analysis is given of the oil extd. by CS_2 from raisin seed.

F. M. SCHERTZ

The commercial distillation of fatty acids and wool grease. G. F. PICKERING. *J. Soc. Chem. Ind.* **44**, 424-30T (1925).—Distn. is carried out in a 3-5 ton still, superheated steam being used to facilitate vapor removal. Al condensers yield the lightest colored product. The volatile fatty acids distil over first, after which the neutral esters decompose. Unsatd. acids contg. more than 1 double bond polymerize during distn., and the polymers are broken up to yield distillates with a low I no. About 2-3% of anhydrides are found in the distillates. The distillates are cooled until crystn. takes place, and the solid acids are removed from the liquid by hydraulic pressing. T. S. C.

Recovery of oil from waste waters. H. KLATTE. *Farbe u. Lacke* No. **44**, 424 (Oct. 22, 1924); *Chimie et industrie* **14**, 229.—The wash waters obtained after treatment of oil with H_2SO_4 contain a certain amt. of oil in the form of an emulsion which cannot be broken by decantation or treatment with petr. ether. K. attributes its stability to the presence of sulfonated oil, which acts as an emulsifier. The emulsion can be broken by sapon.

A. PAPINEAU-COUTURE

Degree of hydrolysis. W. PRAGER. *Z. deut. Oel-Fett-Ind.* **45**, 310-1 (1925).—The formula $x = 100 S/V$, in which S represents the acid no. and V the sapon. no., expresses the % of free fatty acids present in the total fatty acid. of the sample. Davidsohn's formula $x = 100 S/N$, in which N stands for the neutralization no. of the fatty acids, removes the influence of the unsapon. matter. Fahrion's formula $x = (100 - y) S/V$, in which y shows the % unsapon. matter, leaves the glycerol radical out of consideration. To overcome these deficiencies P. proposes the following formula: $x = [100 - y - (38 N_1/3 M)] S/V$, in which N_1 represents % neutral fat as calcd. from Fahrion's formula; $N_1 = 100 - y - x$, while M represents the estd. mean mol. wt. of the fatty acids. The calcd. results agree closely with the actual values. P. FISCHER

• **"Washing powder."** H. GUTTIN. U. S. 1,551,557, Sept. 1. A hot soap compn. contg. Na_2CO_3 or other crystallizable constituents is sprayed into a tower which is supplied with air cooled by expansion in an expansion motor. Heat of crystn. is thus absorbed and a powd. product is obtained.

28—SUGAR, STARCH AND GUMS

J. W. ZERBAN

Filtration of raw beet diffusion juice. D. C. MORRIS. *Intern. Sugar J.* **27**, 479-82 (1925).—A thorough investigation of the adaptability of Celite filter aids to the filtration of beet diffusion juices was undertaken, especial attention being given to the

following factors: (1) A comparison of the efficiencies of the various filter aids. (2) Effect of temp. upon rate of filtration. (3) Influence of p_H . (4) Effect of filtration upon impurities. Preliminary expts. showed that much better results could be obtained with "Hyflo Supercel" than with "Filter Cel" or "Standard Supercel." The rate of filtration at 85° was approx. twice that at 49°. Detn. of the rate of filtration at different p_H values showed that it was nearly 4 times as rapid at p_H 7.0 as at 8.8. The addition of small quantities of lime to the juice, while retarding the rate of filtration, did not impair the quality of the filtrate. The app. used in the expts. consisted of a small plate-and-frame filter press with a total filtering area of 4.5 sq. ft. with suitable pumps, tanks, etc. The effect of the filtration was to reduce the non-sugar content of the thick diffusion juice 5.9%. Also in *Planter and Sugar Mfr.* 75, 169-71 (1925). W. L. OWEN

Coloration of (beet) juices in pressure and vacuum evaporators. I. General. C. T. TCHASKALIK. *Centr. Zuckerind.* 33, 374-6 (1925).—A review of previous work, including that of Linsbauer and Fišer (*C. A.* 19, 2883). II. Coloration in the triple effect under pressure at the Tschauchelwitz sugar factory. *Ibid* 475-6.—The evaporator consists of ordinary standard verticals, except that the bottom of the first effect has been rebuilt to decrease the liquor space. Heating surface (a), juice temp. (b), time juice is in the effect (c), and relative color per 100 polarization (d), from expts. over 5 days at different times during the campaign, are: thin juice, (b) 118°, (d) 1.00; 1st effect, (a) 270 sq. m., (b) 121°, (c) 2.7 min., (d) 1.058; 2nd effect, (a) 350 sq. m., (b) 113°, (c) 12.6 min., (d) 1.242; 3rd effect, (a) 270 sq. m., (b) 105°, (c) 14.7 min., (d) 1.365, after-evaporator, (a) 185 sq. m., (b) 94°, (c) 13.8 min., (d) 1.400. Full data with compn. of juices are given. As the campaign progressed the color of the thin juice doubled, but the increase in color in St. per 100 polarization did not increase.

III. Coloration in the triple effect under pressure at the Ottmachau sugar factory. H. A. SCHLOSSER. *Ibid* 504-8.—An extensive review of the literature is given. The Brandt and Lhuillier evaporator (very similar to the Vincik-Turek evaporator (*C. A.* 17, 3802)) is described and illustrated. Data for 16 tests at irregular intervals through the campaign are: (symbols as above) thin juice, (b) 118.0°, (d) 1.00; 1st effect, (a) 900 sq. m., (b) 123°, (c) 3-4 min., (d) 1.010; 2nd effect, (a) 900 sq. m., (b) 111.1°, (c) 6 min., (d) 1.041; 3rd effect, (a) 1000 sq. m., (b) 101.3°, (c) 8 min., (d) 1.145. No correlation could be found between compn. of juice and amt. of color increase.

IV. Coloration in the quintuple vacuum evaporator at the Heidersdorf sugar factory. W. KÖRHE. *Ibid* 531-4.—The evaporator has 7 bodies, the 2nd and 4th effects having 2 bodies each. Juice goes through all 7 in series. All are standard verticals, except that the last 3 have no down take. Data from 16 tests show: thin juice, (b) 105°, (d) 1.000; body I, (a) 300 sq. m., (b) 112°, (c) 5.41 min., (d) 1.110; body IIa, (a) 461 sq. m., (b) 103°, (c) 11.71 min., (d) 1.144; body IIb, (a) 200 sq. m., (b) 103°, (c) 5.72 min., (d) 1.155; body III, (a) 350 sq. m., (b) 94°, (c) 14.82 min., (d) 1.272; body IVa, (a) 150 sq. m., (b) 87°, (c) 6.66 min., (d) 1.300; body IVb, (a) 155 sq. m., (b) 88°, (c) 7.75 min., (d) 1.322; body V, (a) 167 sq. m., (b) 62°, (c) 10.32 min., (d) 1.318. Increase in color with increase of time in the evaporator body is noticeable.

V. Summary. C. TCHASKALIK. *Ibid* 560-3.—The data of these expts. are considerably more favorable to the pressure evaporator than those of Linsbauer and Fišer. The 2 investigations conclusively prove that the pressure evaporator need not cause as much discoloration as is found in some vacuum evaporators. Special high-speed evaporator bodies may give better colored juices, but even standard evaporators under pressure are entirely satisfactory as compared with vacuum evaporators.

W. L. BADGER

The question of decolorizing preparations. J. SAUER. *Z. Zuckerind. czechoslov. Rep.* 49, 288-90 (1925).—Polemic.

W. L. BADGER

New methods of dry liming. E. GOGELA. *Centr. Zuckerind.* 33, 477. F. BRUKNER. *Ibid* 534. A. GRILL. *Ibid* 563-4 (1925).—Comments on Schrader's article (*C. A.* 19, 1505) and descriptions of similar devices.

W. L. BADGER

Microscopic examination of beet and cane molasses, and other applications of the microscope in sugar manufacture. F. KRYZ. *Z. Zuckerind. czechoslov. Rep.* 49, 295-7 (1925).—A microscopic examn. is the quickest and simplest method for detg. fine grain in molasses. Beet and cane molasses can be differentiated, the former containing needles (raffinose) and octahedral crystals of inorg. constituents; the latter, fine single needles, fragments of plant cells, and drops of a dark-brown liquid insol. in the molasses. Other suggested uses are examn. of filter aids (kieselguhr, etc.), crystal forms in fillmass samples, etc.

W. L. BADGER

Studies on starch. W. WINDISCH. *Wochschr. Brau.* 41, 3-5 (1924); 42, 181-3, 187-9,

193-5, 199-201(1925).—A discussion of the more recent developments on the nature of stagch and the products of hydrolysis.⁴ C. N. FREY

The most effective nitrogenous fertilizer for sugar beets (WAGNER) 15.

BARDORF, CHARLES FREDERICK and BALL, J. A. B.: *The Elements of Sugar Refining*. Easton, Pa.: The Chemical Publishing Co. 240 pp.

29—LEATHER AND GLUE

ALLEN ROGERS

Alfred Seymour-Jones. H. R. PROCTOR. *J. Soc. Leather Trades Chem.* 9, 403-4 (1925).—An obituary. H. B. MERRILL

The chemist in the tannery. MARCEL GILLAT. *Cuir tech.* 14, 330-4(1925).—A discussion. H. B. MERRILL

Chrome tanning. IX. A bibliography of chrome tanning. Part IV. DONALD BURTON. *J. Soc. Leather Trades Chem.* 9, 383-5(1925).—Cf. *C. A.* 18, 2085.

Burma oak and chestnut tans. J. A. PILGRIM. *Indian Forest Records* 10, 263-352 (1924).—The difference between the oakwoods of Burma and those of Europe consists mainly in the tendency on the part of the tannin in the former rather to resemble that of the oak bark of Europe than that of European oak wood, in that it veers towards catechol-tannin reactions, often with a correspondingly redder infusion than that obtained from the European wood. This tendency is strongly marked in the case of *Q. lindleyana* and *fenestrata* (closed acorn type). Nevertheless these wood seem to possess in sufficient degree the wt.-giving properties usually associated with oak tannages. On the other hand, the wood of *Q. fenestrata* (open-topped-acorn type) and *griffithii* show a preponderance of pyrogallol tannin, thus resembling English oak wood. Small-scale tanning tests have shown that oak woods contg. the most pyrogallol tannin give the best wt. A veering towards catechol-tannins is accompanied by the production of redder leathers, as also not quite such a good yield in wt. of dry leather. Compared with some Indian oaks a sample from Simla gave a theoretical yield of 8.7% of crystal ext. with a theoretical max. possible % of tannin of 50%, this tannin being somewhat on the red side. Bark of the same species (*incana*) gave a 20% yield with a max. possible % of 64% of tannin. The best yield of a Burma *Q. fenestrata* was obtained with the open-topped acorn type, namely 19% of a 60% "crystal." Other products of the oak, as galls and cortex barks, should furnish promising material for red. Dyeings with cortex bark of *Q. griffithii* give sufficiently full cutch-brown shades on wool, silk and cotton to indicate that the tan ext. is likely to be quite useful as a dye-stuff. The Burma chestnuts gave even more surprisingly good results than the best of the oaks, 2 species yielding 80 and 74% "crystal" ext. Should chem. or other bleaching seem desirable on account of the presence of reds, or generally to improve the color, most of these tanstuffs are high enough in their proportion of tannins to sol. non-tannins to stand a moderate treatment of this kind. W. O. E.

British Section Committee on Hide Powder and Tannin Analysis. Second Report. F. C. THOMPSON, W. R. ATKIN AND OTHERS. *J. Soc. Leather Trades Chem.* 9, 405-7 (1925); cf. *C. A.* 19, 2143.—Results obtained in the detn. of non-tans are more concordant if the hide powder is previously soaked in an acetate buffer soln., $pH = 4.6$.

Determination of total sulfur in tanning extracts. G. PARSY. *J. Soc. Leather Trades Chem.* 9, 400-2(1925).—Combustion of the material in a calorimeter bomb, with subsequent detn. of S as $BaSO_4$, is described. H. B. MERRILL

Determination of pH value of tanning extracts. DE LA BRUERE. *J. Soc. Leather Trades Chem.* 9, 418-9(1925).—Curves are given showing the [apparent] pH values of tanning exts. as a function of time of contact of the soln. with the electrode. pH values were detd. with the hydroquinone electrode, with various concns. of hydroquinone and with the H electrode. In the author's opinion, these curves show the optimum conditions for the detn. It is concluded that the hydroquinone electrode is superior to the H electrode, "the results obtained with the latter varying much with the time of passage of the gas." H. B. MERRILL

Ultra-violet spectroscopy of tanning extracts and pH value. DE LA BRUERE. *Cuir tech.* 14, 266-71; *J. Soc. Leather Trades Chem.* 9, 427-37(1925).—The ultra-violet

absorption curves of several exts. were found to be practically independent of p_H value. The absorption curve of gelatin soln. was detd. at 3 p_H values in acid soln. and was the same in all cases.

Uniformity in reporting analyses of crude tanning materials. G. COLCHEN AND A. FIEVES. *J. Soc. Leather Trades Chem.* 9, 408-10(1925).—It is suggested that the ratio, tannin: insol. matter, gives the most significant information about the progress of an extn.

Provisional methods for the analysis of vegetable-tanned leather. CZECHOSLOVAKIAN SECTION OF THE SOCIETY OF LEATHER TRADES CHEMISTS. *J. Soc. Leather Trades Chem.* 9, 380-3(1925).—A compilation of familiar methods.

Comparative durability of chrome- and vegetable-tanned sole leathers. R. C. BOWEN AND M. N. V. GEIB. *Bur. Standards, Tech. Paper No. 286*, 267-86(1925).—Natural and filled chrome sole leathers were compared in wearing quality with vegetable leather. The materials, the tests and the comparative properties of the leather as reflected by the wear, chem. and hygroscopic tests and general observations on thickness and area are described. Natural and paraffin-filled chrome leather will outwear vegetable leather at least 2:1 per unit of thickness. A mineral filler such as barytes reduces the wearing quality, but it is still greater than that of vegetable leather. Chrome sole leathers have disadvantages in appearance, lack of firmness, lack of moisture resistance, and tendency to slip, which property is but partly overcome by the addn. of filling agents. Numerous illustrations and tables are included.

Dyeing of leather tanned with synthetic tannins. G. E. KNOWLES. *J. Soc. Dyers Colorists* 41, 308-11(1925); cf. *C. A.* 16, 1030.—Sheep skins tanned entirely with Maxynton SS were compared with sheep skins tanned entirely with sumac when each was dyed with the same color. Tests were made with 135 colors and the results assembled in a table which shows a choice of colors to produce the same effects with either method of tanning.

The chemical reactions of the skin. Fixation of acids by skin. ANDREA PONTE. *J. Soc. Leather Trades Chem.* 9, 386-99(1925).—Strips of bated calf skin were immersed in large vols. of the following acids: H_2SO_4 , HCl, HOAc, HCOOH, $H_2C_2O_4$, tartaric acid and citric acid in consns. of N , 0.1 N and 1%. After 15 hrs. the strips were washed with varying amts. of H_2O or EtOH. Acid remaining in the strips was detd. by displacement with Na_2HPO_4 and titration. Results indicate that stronger acids are more firmly bound than weaker, and polybasic than monobasic.

Extraction of chromium from chrome leather by means of sodium potassium tartrate. N. I. BERESTOVOJ AND LIBOSLAV MASNER. *J. Soc. Leather Trades Chem.* 9, 449-53(1925); cf. *C. A.* 10, 1044.—Extn. is favored by increasing temp.; by increasing the ratio of the tartrate to leather, up to a certain limit; by increasing the diln. of the soln. (cost of tartrate const.); and by increasing the leather surface exposed. Regeneration of the tartrate is less easy than previous workers have indicated.

The disinfection of anthrax hides by Schattenfroh's method. L. PIRAS AND A. DEPASCALE. *Igiene moderna* 17, 385(1924); *Bull. mens. office intern. hyg. publ.* 17, 293(1925).—This method, which involves the use of NaCl and HCl, is easy to apply. Tests were made on guinea-pig skins but these are considered to give results applicable to heavy hides as Sclavo and DiVestea have shown that anthrax spores when found are practically at the surface.

Defatting hides. H. T. BÖHME AKT.-GES. CHEMISCHE-FABRIK. Brit. 230,421, Jan. 20, 1925. Mixts. of solvents of different fat-dissolving power are used, e. g., equal vols. of C_2HCl_3 and tetrahydronaphthalene.

Fiber board. A. L. CLAPP. U. S. 1,552,036, Sept. 1. A fiber board adapted for manuf. of rands or heel boards comprises felted cellulosic and leather fibers and disintegrated waste contg. a thermoplastic compd., e. g., box toe waste and added montan wax, the thermoplastic compd. being pptd. throughout the material, e. g., alum.

Thermoplastic shoe-stiffening mixture. A. L. CLAPP. U. S. 1,552,037, Sept. 1. Cellulosic fiber, leather fiber and cattle hair are felted and associated with a thermoplastic material such as asphalt and montan wax. Cf. *C. A.* 19, 2731.

Tannin. G. C. HOWARD. U. S. 1,551,881, Sept. 1. Bark or other similar material contg. tannin is reduced to small particles which are dried so that the tannin can be sepd. from them in the form of a dust.

30—RUBBER AND ALLIED SUBSTANCES

C. C. DAVIS

The constitution of rubber and a new rubber. H. STAUBINGER. *Rev. gén. caoutchouc* 2, No. 13, 5-8(1925).—Substantially the same as C. A. 19, 1791. C. C. DAVIS

What are the reasons for the characteristic elasticity of rubber? II. The Joule effect and the new structure of the substance arranged in three dimensions by the stretching. J. R. KATZ. *Kolloid-Z.* 37, 19-22(1925).—Chiefly a discussion of earlier work (cf. C. A. 19, 2144, 2759, 3035). Previous to the transformation of amorphous to cryst. rubber on stretching the heat effect is negative, and it changes to positive only when the X-ray diagram indicates the formation of a cryst. substance. F. B. BROWN

Guayule, a high-grade rubber. ANON. *India Rubber World* 72, 652-3(1925).—The botany, occurrence, extrn., prepn., yield and properties of guayule are described. Because of the deficiency of org. acids in crude guayule, the highest quality when vulcanized can be attained with such accelerators as PbO only by the addn. of suitable org. acids. Furthermore ultra-accelerators like tetramethylthiuram disulfide have such a favorable action that with these accelerators rubber mixts. in which pale crepe or smoked sheet is replaced in part by guayule give much the same quality when vulcanized as those with high-grade rubber alone. C. C. DAVIS

"Heveic" acid. A correction. G. STAFFORD WHITLEY. *India Rubber J.* 70, 382(1925).—The fatty acid isolated by W. from the resin of *Hevea* rubber, which was thought to be a previously unknown acid and for which the name *heveic acid* was proposed (cf. C. A. 18, 1589) was probably only impure stearic acid. C. C. DAVIS

The examination of raw materials in the rubber industry. I. PAUL MENSIER. *Rev. gén. caoutchouc* 1925, No. 13, 11-4.—A survey of the types of materials encountered. C. C. DAVIS

Testing of rubber adhesive plaster and insulating tapes. RUDOLF DITMAR. *Chem.-Ztg.* 49, 636-7(1925).—The phys. and chem. properties desirable in rubber adhesive plaster and tape are described. To test the adhesive power of a tape, a strip is folded back on itself and compressed and then both the force required to sep. the adhered strips and the length of the fibers at the line of sepn. are measured. The coeff. of adhesion is the product of this force and the length of fiber per unit width of tape at a standard temp. and with the standard conditions and dimensions of the particular app. C. C. DAVIS

The more complete evaluation of the pigment reinforcement of rubber. WM. B. WIEGAND. *Ind. Eng. Chem.* 17, 939-41(1925); cf. C. A. 19, 2423.—Proof resilience, the area subtended on the strain axis by the stress-strain curve, may be expressed as

$\int_{E_0}^{E_R} T dE$, where E_R is the elongation at rupture and T is the load. From the base mixt. contg. no pigment to the mixt. contg. the max. quantity this integral changes progressively in a manner which is characteristic of each pigment. "A" function is defined as the integral of the proof resilience (E_p) with respect to the vol. of pigment (V) between

any limits assigned, thus: $\int_{V_0}^{V_1} E_p dV$, or $\int_{V_0}^{V_1} \int_{E_0}^{E_R} T dE dV$. In the first case it is represented by the area subtended on the pigment vol. axis by the proof resilience curve, in the second case it must be represented in 3-dimensional form. "A" function includes both the proof resilience imparted by the pigment and that of the base mixt. and therefore to obtain a criterion of the reinforcing power of a pigment another factor, " ΔA " function must be detd. This is defined as the excess proof resilience developed by a pigment over the entire range of vols. in which it improves the phys. quality of the base mixt. Recalculation of earlier data to show proof resilience as a function of vol. of pigment emphasizes the utility of " ΔA " function as an index of the value of a pigment. Thus the most satisfactory pigment is one which unites the highest possible value of its " ΔA " function with a min. rate of decline of the curve at higher vols. C black is superior to other pigments in this respect. $MgCO_3$ also has a high reinforcing power in small vols. but this power decreases more rapidly than with C black with increasing vols. ZnO and China clay are inferior to these and lithopone, whiting and barytes have almost no significant " ΔA " function. With increasing vols. of pigment; 2 opposing tendencies influence the proof resilience, the addn. of surface energy by the pigment phase and the decline in the resilience of the rubber phase through dila. A relation

perhaps exists between the shape of the "A" function curve and the shape of the particles, the rate of advance to the optimum reinforcing power and the subsequent decline depending upon whether the particles are irregular, *i. e.*, have a large surface area, or are spherical. The rate of increase of surface energy with increase in vol. of pigment and the subsequent decline in reinforcing power at still higher vols. differ in the 2 cases because of dissimilar orientation and agglomeration, and so differences are found in the "ΔA" function and in the value of the pigments in rubber compounding. C. C. D.

The effect of colloidal silicic acid in rubber mixtures. F. K. *Gummi-Ztg.* 39, 102-4 (1925).—To rubber-S mixts., accelerated and unaccelerated, were added increasing vols. of colloidal SiO_2 and the stress-strain curves of the vulcanized products. With increasing proportions of SiO_2 the curves indicated a stiffening effect of the character as that imparted by reinforcing agents like C black, MgCO_3 , ZnO and Fe_2O_3 . The max. reinforcing effect was reached with mixts. contg. 20-40% SiO_2 by 8-36 parts by vol. per 100 parts of rubber, showing that a greater vol. of SiO_2 per reinforcing fillers can be incorporated in a rubber mixt. without impairing elasticity. Like the other reinforcing fillers, a stiffening effect was manifest with SiO_2 vulcanization. The colloidal SiO_2 , d. 1.635, was composed of particles of $1-2\mu$ with a strong Brownian movement. C. C. DAVIS

Vulcanization. I and II. G. BERNSTEIN. *Rev. gén. caoutchouc* 1925, No. 12, 13, 8-11.—A description with quant. data. Typical formulas and cures, sp. heats of compounding ingredients and tables of the lag for different thick-rubber in step-up cures are given. C. C. DAVIS

Vulcanization accelerators. I. G. S. WHITBY AND H. E. SIMMONS. *Ind. Eng. Chem.* 17, 931-5 (1925).—In continuation of work on piperidinium pentamethylenedithiocarbamate (C. A. 15, 3770; 17, 3808) a study was made of the effects of varying the amts. of S and of accelerator, the influence of the nature of the ZnO and the influence of the substituent M in the type accelerator R_2NCSSM . Judged by the stress-strain curves both the max. degree of stiffness imparted to a vulcanizate and the maintenance of this quality over a wide range of cures depend upon the % S and accelerator on the rubber. Below certain min. quantities the stress-strain curves are not altered much by prolonged curing, probably because the catalytically active agent is destroyed (cf. Schidrowitz and Burnand, C. A. 16, 1033; Twiss, Brazier and Thomas, C. A. 16, 2043). Because of this destruction the amts. of S and accelerator can be so chosen that "flat curing" is obtained where the accelerator is powerful enough to bring about vulcanization at temps. at which S alone is ineffective. The fact that the deleterious effect of heat is minimized when rubber is vulcanized with accelerators is inadequate to explain the quality obtained. Accelerators have a positive action in that they enhance the colloidal change characteristic of vulcanization, to which combination with S is probably only incidental. The rate of vulcanization as well as the quality is influenced so greatly in some cases that the accelerating factor of Twiss (cf. C. A. 14, 2430) is meaningless. In small quantities the activating influence on the accelerator of ZnO of the greatest fineness exceeds that of ordinary ZnO , but when the amt. of ZnO is large, vulcanization is slower with fine than with ordinary ZnO . The Zn salt of pentamethylenedithiocarbamic acid is much less active than an equimol. quantity of the piperidinium salt and moreover the activity of the former is increased by the addn. of piperidine. A similar increase of activity is obtained by the addn. of piperidine to di- α -thionaphthoyl disulfide. That this is not true in general however is indicated by the fact that methylaniline does not increase the activity of Zn phenylmethyldithiocarbamate, whereas the addn. of piperidine to the latter does do so. In general piperidine has an effect on the rate of vulcanization and on the quality which cannot be obtained in its absence. C. C. DAVIS

Regeneration [of rubber]. LUDWIG STOLL. *Gummi-Ztg.* 39, 1798-800 (1925).—A review of articles and patents dealing with the reclaiming of vulcanized rubber, with a bibliography of 159 references. C. C. DAVIS

Determination of the viscosity of very viscous solutions (DITMAR) 2.

Treating latex. E. HOPKINSON. *Can.* 250,476, June 9, 1925. A finely divided homogeneous mixt. of latex and a filler is chlorinated; when 8-10% of Cl has been absorbed the product is calendered and the surfaces of the calendered material are subjected to the action of Cl to remove tackiness.

Vulcanization of rubber. R. V. HAUSER. Can. 252,665, Aug. 11, 1925. Rubber is heated with S and *o*-tolylguanidine.

Vulcanization of rubber. L. B. SEBRELL. Can. 251,758, July 14, 1925. Mercaptothiazoline is added as an accelerator. Cf. C. A. 19, 192.

CHEMICAL ABSTRACTS

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No. 22

1—APPARATUS AND PLANT EQUIPMENT

W. L. BADGER

The task of apparatus construction. Coöperation between engineer and chemist. LUDWIG MEYER. *Chem. App.* 12, 154-5, 183-5(1925).—A general discussion.

Innovations in the construction of laboratory balances. WALTER BLOCK. *Z. Instrumentenk.* 45, 165-75(1925). J. H. MOORE
OSCAR PAUK

Reply to the note of W. H. F. Kuhlmann concerning the ultrabalance. FRIEDRICH HOLTZ. *Ber.* 58B, 1924(1925); cf. *C. A.* 19, 2285.—A defense of H's statements in the previous paper (*C. A.* 19, 4356). R. J. HAVIGHURST

A new calorimetric bomb with platinum lining. CHARLES MOUREU AND PHILIPPE LANDRIEU. *Bull. soc. chim.* [4], 37, 986-96(1925).—The original bomb designed in 1885, and satisfactory in service, contained 1,300 g. Pt. On its destruction through accident, enamel, Ni and alloy-steel linings were tried and found unsatisfactory. M. and L. reduced the amt. of Pt to 128 g. by modifying the closure (somewhat along the lines of that of the Kroeker and Atwater bombs), and by lining with a foil of Pt (0.2 mm.), Au (0.4 mm.) and Cu (0.4 mm.) made by a rolling Pt-Au-Cu block of proper size. It has given entire satisfaction. A. PAPINEAU-COUTURE

Demonstration of simple apparatus for the estimation of carbon dioxide. EZER GRIFFITHS. *Proc. Phys. Soc. (London)* 37, 348(1925).—To provide marine engineers with a means of CO₂ detn. in the presence of apples, etc., three kinds of special app. are described: (1) a gas buret with KOH bulb, (2) a large hollow-barrel glass top contg. absorbent, the vol. change being measured, (3) a tube fixed so that Hg would drive the sample through an absorbent cartridge followed by measuring the pressure change. F. O. ANDEREGG

A simple apparatus for carbon dioxide determination. GEORG WITTIG. *Ber.* 58B, 1925(1925).—The app. consists of 2 bulbs that can be joined by means of a ground-glass joint. The upper bulb carries an attached tube filled with granular CaCl₂ that has been satd. with CO₂. It is also provided with an internal syphon tube. The upper bulb is filled with 2 N HCl. 0.2-0.3 g. of the carbonate sample is weighed into the lower bulb and covered with about 4 cc. H₂O. The bulbs are joined and weighed. The HCl is then slowly forced through the syphon tube into the lower bulb. When the entire acid has been transferred to the lower bulb and the evolution of CO₂ has been completed, the bulbs are evacuated and refilled with air about 8 times. A second weighing gives the wt. of the evolved CO₂. A single detn. requires about 1 to 1½ hrs. The accuracy of the method is about 0.2% CO₂. R. L. DOUGÉ

An improved continuous-reading hydrogen-ion meter. K. H. GOODE. *J. Am. Chem. Soc.* 47, 2483-9(1925).—An improvement of the Goode continuous-reading electrotitration app. (*C. A.* 16, 665) has been effected by making use of the amplifying characteristics of the vacuum tube to magnify the currents to such a value that they can easily be measured with a milliammeter. A device is completely described which, by making use of the 3-electrode vacuum tube as a voltmeter, and as a d. c. amplifier, serves to indicate upon the scale of a milliammeter the potential between any 2 electrodes ordinarily used in electrochem. work. The device does not draw any appreciable current from the source to be measured and is continuous and automatic in its operation. For complete details the original should be consulted. R. L. DOUGÉ

Automatic recorder for measuring size-frequency distribution of grains. R. H. LAMBERT AND E. P. WHEATMAN. *J. Opt. Soc. Am.* 11, 393-402(1925).—A description is given of a photographic recorder for measuring the motion of the meniscus of a column of liquid in the side arm of a U type sedimentation tube. Light will pass through the tube filled with the liquid and focus on a strip of sensitive paper under it but an empty portion of the tube is nearly opaque to the light at the position of the paper. Ordinary sensitized paper may be used which can be obtained of such a length and width, as will

be suitable for a desired expt. An expt. may proceed over an almost indefinitely extended time. A control device for making the exposure is described. The mathematical method for correcting data is given. An actual sedimentation record is also presented.

R. H. LAMBERT

The skopometer: An instrument for measuring color, cloudiness, and other optical phenomena of liquids. WM. G. EXTON. *Proc. Soc. Exptl. Biol. Med.* **21**, 181-2 (1924).—The necessity of using standards for comparison has been eliminated. Color is measured in terms of absorption and cloudiness by means of several different optical principles.

R. J. C.

A compressed air meter. WELISEK. *Z. komprimierte flüssige Gase Pressluft-Ind.* **24**, 7-8 (1925); cf. *C. A.* **18**, 769.—A compressed air meter has been designed using the principle of the Luxs float. A vertical heavy-walled, glass tube, slightly tapered inside, with wider section at the top has inside it an Al float of suitable wt. The gas flowing through the tube lifts the float to a height proportional to the vol. of gas flowing. The app. is built in com. sizes by Demag, Duisburg.

R. L. DODGE

A new form of radiometer. R. L. HANSON. *J. Optical Soc. Am.* **11**, 283-8 (1925).—A very simple and sensitive radiometer is completely described. A Rayleigh disk of Al foil is suspended by a quartz fiber in a chamber in such a position that convection currents set up by an absorbing target will move the disk. The motion of the disk is transferred to a scale in the usual way by reflection of a light spot from a mirror mounted on the fiber. The absorbing target is of sheet silver coated with lamp black and is located just inside a thin window through which the radiant energy to be measured enters the app. Refinements of thermostating, protection from jar, and shielding from stray light sources gave an instrument having a sensitivity of 8×10^{-9} watts per mm. scale division, corresponding to approx. $1/11$ of the highest sensitivity of a Nichols radiometer. Like the Nichols radiometer this instrument has the disadvantage of a very long period, the time required for the disk to come to a steady state being about 10 min.

R. L. DODGE

A rotating dialyzer. A. ASTRUC AND E. CANALS. *J. pharm. chim.* [8], **2**, 14-7 (1925); cf. *C. A.* **12**, 1521, 1722; **16**, 3236.—The Graham dialyzer is attached to a rotating tube (150 r. p. m.) inside of which a stem stirrer rotates oppositely (250 or 150 r. p. m.), both being actuated by a motor. The rotation method shows a distinct increase in the speed of dialysis of 0.1 N solns. of NaCl, NaBr and NaI (20 cc. soln. into 200 cc. of H₂O). Gum arabic which retards the speed of ordinary dialysis (20 cc. mixt. of 0.1 N NaCl and 10% gum arabic, equal wts., into 150 cc. H₂O, or into running H₂O) has no retarding effect when rotation is used; with gum tragacanth, retardation is also diminished, although not to 0.

S. WALDBOTT

Steam traps for chemical processes. H. ATKIN. *Ind. Chemist* **1**, 154-5 (1925).—Four types of steam traps are described. They are classified by the principle on which they are constructed into float, siphon, bucket and expansion traps. The action of the traps is explained by aid of 7 illustrations.

L. W. RIGGS

The Geophysical Laboratory furnace thermostat. H. S. ROBERTS. *J. Optical Soc. Am.* **11**, 171-86 (1925).—This article gives a detailed description of the regulator described previously by White, Roberts and Adams but summarizes the improvements and modifications which have been made (cf. *C. A.* **7**, 2304; **13**, 2304; **16**, 365; **17**, 1561; **19**, 421). The regulator will hold an elec. furnace within 0.1° as far up as 1200° for hrs. without attention.

D. E. SHARP

A simple thermoelectric thermostat. D. STOCKDALE. *J. Sci. Instruments* **2**, 392-7 (1925).

E. H.

Analysis of bi-metal thermostats. S. TIMOSHENKO. *J. Optical Soc. Am.* **11**, 233-55 (1925).—A general theory of bending of a bi-metal strip subjected to a uniform heating is developed. This theory is applied in analysis of operation of a bi-metal strip thermostat. Equations are given by means of which the dimensions of the thermostat for a given temp. of operation and a given complete range of temps. can be calcd. For details the original should be consulted.

R. L. DODGE

A new vacuum thermoclement. W. J. H. MOLL AND H. C. BURGER. *Phil. Mag.* **50**, 218-24 (1925).—See *C. A.* **19**, 2577.

S. C. LIND

Theory of evaporation (PRAČEK) 28. Stationary extraction plants (HASSEL) 13. Shaped articles of metal oxides (U. S. pat. 1,553,394) 18.

Acetylene generator. J. K. E. DIFFENDERFFER. U. S. 1,553,517, Sept. 15.

Acetylene generator. C. J. CLETON. U. S. 1,550,010, Aug. 18.

Apparatus for filtering liquids. C. W. SIRCH. U. S. 1,554,043, Sept. 15.

- Filter for gasoline, etc. R. H. B. FIGG. •Brit. 230,991, March 13, 1924.
- Filter for air. C. P. HEGAN. Brit. 231,435, March 27, 1924. See U. S. 1,515,949 (C. A. 19, 194).
- Apparatus for cleaning, humidifying and "supersaturating" air. J. J. PREBLE. U. S. 1,554,185, Sept. 17.
- Humidity- and temperature-regulating apparatus. W. H. CARRIER. U. S. 1,554,784-5, Sept. 22.
- Apparatus for drying combustible material by fire gases. O. HUBMANN. U. S. 1,554,854, Sept. 22.
- Apparatus for absorbing gases. G. RATH. U. S. 1,553,718, Sept. 15.
- Apparatus for spray desiccation of milk or other liquids. C. M. BURDETTE. U. S. 1,554,330, Sept. 22.
- Retort for distillation of coal and other carbonaceous substances. T. M. DAVIDSON and H. I. ARMSTRONG. U. S. 1,552,471, Sept. 8.
- Apparatus for destructive distillation of pulverulent calcium acetate or other materials by contact with molten metal. D. RIDER and THERMAL, INDUSTRIAL & CHEMICAL RESEARCH CO., LTD. Brit. 218,807, Jan. 4, 1925.
- Apparatus for distilling and carbonizing solids or liquids. F. DUPLAN. Brit. 225,337, Oct. 16, 1923.
- Wrought iron annealing pot. P. BREDDIN. U. S. 1,555,263, Sept. 29.
- Shaft furnace for high-temperature chemical and metallurgical reactions. A. HELFENSTEIN and HELFENSTEIN-ELEKTRO-OFEN GES. Brit. 231,203, March 24, 1924.
- Glass or quartz laboratory vessels. JENAER GLASWERK SCHOTT & GEN. Brit. 231,857, April 5, 1924. A coating of vulcanized rubber on the upper portion of the outside of laboratory vessels enables them to be held in the hand when hot.
- Prism for dipping refractometers. F. LÖWE. U. S. 1,553,786, Sept. 15.
- Reversing apparatus for regenerative furnaces. G. H. ISLEY. U. S. 1,553,242, Sept. 8.
- Retort furnace. H. KOPPERS. Brit. 212,274, March 2, 1923.
- Viscometer. R. ROBERTS. Brit. 232,070, June 5, 1924. The rate of exudation of an oil, etc., at a regulated temp. is noted to det. the viscosity in the app. described.
- Viscometer bath. J. P. BADER. U. S. 1,549,898, Aug. 18.
- Thermoelectric pyrometer. R. HASE. Brit. 231,398, Nov. 3, 1924. •
- Thermostat. L. J. KIMMEL and G. TORRESON. U. S. 1,555,419, Sept. 29.
- Metallic parts for high vacuum tubes. W. ROHN. U. S. 1,555,316, Sept. 29. Al, Cu, Ni, Fe or other metals used are repeatedly heated to their m. p. under a const. but very low pressure and then annealed.

2—GENERAL AND PHYSICAL CHEMISTRY

• GEORGE L. CLARK AND BRIAN MEAD

• Rhenium and masurium. •W. NODDACK AND I. TACKE. *Oesterr. Chem.-Ztg.* 28, 127-30 (1925); cf. C. A. 19, 178.—N. and T. predict the phys. properties of elements 43 and 75 and their compds., and show by mol. wt., d., m. p. and X-ray spectroscopy that they are probably present in Pt ores and in columbite. G. C.

Geochemical distribution law of the elements. V. Isomorphy and polymorphy of the sesquioxides. The contraction of the "lanthanums" and its consequences. V. M. GOLDSCHMIDT, T. BARTH and G. LUNDE. *Skrifter Norske Videnskaps. Akad. Oslo., 1 Mat.-Nat. Kl.* 1925, No. 7, 59 pp.; cf. C. A. 19, 2764.—The contraction in the shell of the atom due to the packing of the electrons is particularly marked in the case of the elements Ce-Lu, which are designated by the authors as the "lanthanums." Evidence in support of this theory is offered in space lattice dimensions of elements preceding and following the "lanthanums." New values are given for the lattice dimensions of Pd = 3.873×10^{-8} , Pt = 3.903×10^{-8} and Rh = 3.795×10^{-8} . The contraction of the "lanthanums" is responsible for many of the geochem. relationships. From a study of mixed crystals the association of Yt with the Yt earths is shown to be a consequence of the contractions of the "lanthanums." This contraction is responsible for the occurrence together of Zr-Hf, Nb-Ta, Mo-W, Ru-Os, Rh-In and Pd-Pt. This work supports the postulate of Goldschmidt that the geochem. distribution of the elements is conditioned by the structure of the electron shell (cf. C. A. 18, 3161). W. H. S.

Average cross-sectional areas of molecules by gaseous diffusion methods. EDWARD MACK, JR. *J. Am. Chem. Soc.* 47, 2468-82 (1925).—A method of detg. diffusion coeffs. is described. From the results obtained, the av. cross-sectional areas of the mols.

of 8 substances are calcd. The values for C_6H_6 , $C_{10}H_8$ and $C_{14}H_{10}$ agree very well with Bragg's X-ray measurements. The av. cross-sectional areas of the Bragg mols. are obtained by constructing wax models to scale and detg. their av. shadow areas. The chain structure of m - C_8H_{10} is probably similar to that of the alc. part of ester mols.; diphenyl and benzidine seem to have the collapsed structure also suggested by chem. evidence.

GEORGE CALINGAERT

Temperature coefficient of viscosity and electrical conductivity of aqueous solutions. MAX WIEN. *Ann. Physik* 77, 560-86(1925).—Consideration of some existing data on the variation of viscosity and elec. cond. of aq. solns. of many electrolytes shows that for each soln., the temp. coeff. of fluidity differs from the temp. coeff. of elec. cond. by a const. There are some exceptions to this rule, but they are not common. Defining the temp. coeff. of fluidity by $\alpha_T = (1/Fl_T)(dFl/dT)$, and that of elec. cond. by $\beta_T = (1/\lambda_T)(d\lambda/dT)$, the above rule can be expressed by $\alpha_T + \gamma = \beta_T$, where γ is nearly always neg. The variation of α with temp. can be expressed by $1/\alpha = a + bT$ very accurately. Integration of this equation yields $Fl_T = Fl_0(1 + q_1(T - t))^p$ where $p = 1/b$ and $q_1 = b/a_1$. Integration of the equation $\beta_T = \alpha_T + \gamma$ yields $\lambda_T = \lambda_0(1 + q_1(T - t))^{pe\gamma(T - t)}$, where p and q_1 have the same meaning as before. The considerations are based on the measurements of Thorpe and Röger (*Trans. Roy. Soc. (London)* 397(1894)), Hosking (*Phil. Mag.* 1902-9), and Schaller (*Z. physik. Chem.* 25, 517(1898)), no very recent data being considered.

F. C. KRACEK

A consideration of equal viscosities. W. HERZ. *Z. anorg. allgem. Chem.* 147, 293-4(1925).—The author has tabulated from Landolt-Börnstein, 5th edition, the temps. at which the viscosities of 41 org. liquids are 0.0040 (c. g. s. units). The ratios between these temps. and the critical temps. of the 41 liquids are calcd. These ratios are all of the same order of magnitude (0.5-0.65), but closer relationship is not immediately evident.

R. L. DODGE

Theories of polar and non-polar free affinities. A practical and theoretical reply to some recent criticisms and comparisons. G. N. BURKHARDT AND ARTHUR LAPWORTH. *J. Chem. Soc.* 127, 1742-50(1925).—Polemical against Ingold (cf. *C. A.* 18, 982).

BRIAN MEAD

Tridentate groups in complexes of tetrahedral and octahedral symmetry. J. D. MAIN SMITH. *J. Chem. Soc.* 127, 1682-7(1925).—Theoretical. Tables are given by means of which the no. of isomerides can be calcd. in complexes contg. 1 nuclear atom and (a) 1 tridentate group with or without a chelate group or (b) 2 tridentate groups.

BRIAN MEAD

The regularities of contraction during the formation of solid chemical compounds. I. I. ZASLAVSKII. *Z. anorg. allgem. Chem.* 146, 315-23(1925); cf. *C. A.* 18, 1261.—The "contraction const.," $C = MV/\Sigma AV$, where MV is the mol. vol. of the compd. and ΣAV is the sum of the at. vols. of the elements or radicals in the compd., is calcd. for 40 chlorides, 38 bromides, 15 permanganates, 15 carbonates, 12 nitrates, 3 sulfides, 3 oxides, 3 iodides, 3 fluorides, 3 sulfates and 3 hydroxides. Wherever possible the calcn. is based on the existing data on the sp. gr. of the elements and compds. The d. of the metalloids, H, N, O, F, Cl, Br and I was computed by Guldberg's rule (cf. *Z. physik. Chem.* 5, 374(1890)). A graphical presentation of the contraction const. makes it certain that each metal and each acid radical that appears in a complicated chem. compd. has qualitatively the same sp. influence on the degree of contraction. Two series of analogously constituted chem. compds. show a decided parallelism in the variations of their contraction const. In a series of similar compds. in which the metals differ widely in their chem. character and the acid radicals are closely related chemically the effect of the metal predominates in detg. the variations in the contraction const., and vice versa.

R. L. DODGE

The melting points of inorganic compounds and those of the elements. ERNST FRIEDERICH AND LIESELOTTE SITTIG. *Z. anorg. allgem. Chem.* 145, 251-76(1925).—Several relations of m. ps. of compds. and elements with other phys. and chem. properties have been observed, but none holds perfectly. The following new relations are pointed out: The m. ps. of binary compds. with approx. equal at. vols. of both constituents increase with the valence. The mol. vols. of the metals and binary F, O, N, C compds. increase with the at. nos. of the metals. The m. ps. of the alkali halides decrease with increasing at. wts. of both constituents except that Li compds. are lowest. The m. ps. of metallic chlorides, bromides and oxides generally decrease with increase of valence of the metal. The m. ps. of the elements increase with valence to 4, and then decrease. Theoretical explanations for these relations are given. In general the m. p. is detd. by the degree of action of the valence electrons of the atoms upon the neighboring atoms.

A. W. FRANCIS

Z. Physik 32, 684-712(1925).—The tension necessary for the maintenance of the drawing of single crystals in the glide planes increases strongly with increasing deformation. This inner slip resistance ("Verfestigung") is set up even for the smallest stresses. Crystallization of the lattice position

the inner slip resistance in the drawing of crystals. Sn crystals illustrate this phenomenon particularly well. The recrystn. of cold-drawn Sn crystals is studied in detail. The content of internal tension energy, and not the degree of drawing, detcs. the ability for recrystn.

PER K. FRÖLICH

Lattice theory of deformable ions. GUSTAV HECKMANN. *Z. Physik* 31, 219-23 (1925).—The deformability of ions must be taken into account in explaining accurately the properties of a lattice. The main, hitherto accepted, laws do not withstand quant. mathematical treatment until the mutual influence of the ions on the electronic structure is given consideration.

GEORGE CALINGAERT

Experiments with explosive gas mixtures and their relation to modern engines. O. OHMANN. *Z. physik. chem. Unterricht* 38, 78-85(1925).—Description of lecture table expts. with explosive mixts. of several gases.

M. BEBER

Explosion experiments with vaporized liquids. O. OHMANN. *Z. physik. chem. Unterricht* 38, 193-200(1925).—Description of lecture-table expts. with explosive mixts. of oxygen and vaporized benzene and benzene

M. BEBER

Deposition of carbon from carbon dioxide of Bunsen flame by means of magnesium. S. GENELIN. *Z. physik. chem. Unterricht* 38, 148-9(1925). C from CO₂ of Bunsen flame is deposited by use of Mg placed in deflagrating spoon which is held in flame for about 5 min., subsequently cooled with a few drops H₂O, treated with HCl, filtered, and washed with H₂O.

M. BEBER

The vapor pressure of sodium. W. H. RODEBUSH AND THOMAS DEVRIES. *J. Am. Chem. Soc.* 44, 2488-93(1925).—By an application of Knudsen's method the vapor pressure of Na has been detd. over the temp. range 181.8-597°. An empirical equation $\log p = -(5922/T) - 1.6184 \log T + 12.9605$ has been fitted to the data from 180° to the b. p. The entropy of Na vapor at 298° K. and 1 atm. is calcd. to be 35.7 ± 0.5 . A drawing of the app. is given.

E. R. SCHIERZ

Critical constants and vapor pressure of hydrocyanic acid. G. BREDIG AND L. TEICHMANN. *Z. Elektrochem.* 31, 449-51(1925).—The tendency of HCN to polymerize, which has been the greatest difficulty in such detcs., was prevented by drying and by use of non-alk. Jena glass app. The crit. temp. is 183.5°, pressure 55.0 kg. cm.² and d. 0.195. The vapor pressure was detd. from -15.2° to the crit. temp.; consts. for the Nerst formula are $C = 2.789$, $\epsilon = 0.021675$ and $\lambda_0 = 7790$. Surface tension is 17.2 dynes/cm. at 25°. All methods of calcn. indicate association in the liquid state, approx. to double mols.

B. H. CARROLL

The states of matter. I. Internal pressure, vapor pressure and critical data. F. SCHUSTER. *Z. anorg. allgem. Chem.* 146, 299-304(1925).—The internal pressure of many non-associated and associated liquids can be calcd. by an equation derived from Stefan's equation (cf. Stefan, *Wied. Ann.* 29, 655(1886)), and the Clausius-Clapeyron equation. The derived equation is $B_i = 41.04 [(T_i T_c \epsilon n p_i) / V (T_i - T_c)]$ where B_i is the internal pressure at the b. p.; T_i is the abs. crit. temp.; T_c is the abs. b. p.; and V is the mol. vol. The values calcd. by this equation, using existing data are: H, 190 atm.; A, 860; Kr, 1234; Cl, 2169; O, 1241; N, 846; Hg, 18,125; HBr, 2277; HI, 2131; H₂O, 10,300; H₂S, 2545; NH₃, 4512; SbCl₅, 2200; SbBr₅, 2013; SiCl₄, 1184; SnCl₄, 1266; SO₂, 2726; N₂O, 2233; CO₂, 897; CS₂, 2177; CH₄, 969 or 1021; *n*-C₄H₁₀, 1009; *n*-C₆H₁₄, 1642; *n*-C₇H₁₆, 990; C₆H₁₂, 1272; C₆H₆, 1576; C₆H₅CH₃, 1397; *m*-C₆H₄(CH₃)₂, 1279; C₆H₅, 1480; CH₃Cl, 2165; CHCl₃, 1718; CCl₄, 1413; C₂H₅Cl, 1783; CH₃CHCl₂, 1613; C₂H₅F, 1524; C₂H₅Cl, 1537; C₆H₅Br, 1552; C₆H₅I, 1538; (C₂H₅)₂O, 1242; (CH₃)₂O, 1996; C₆H₅S, 1618; CH₃OH, 4282; C₂H₅OH, 3087; iso-C₄H₉OH, 1912; CH₃COOH, 2983; HCOOCH₃, 2178; CH₃COOC₂H₅, 1493; C₂H₅NH₂, 2012; and C₆H₅NH₂, 2023. The values so calcd. agree well with those calcd. by Walden (cf. *C. A.* 3, 2077) by another method. Calcn. of the variation of internal pressure with temp. for several non-associated and associated liquids indicates that for non-associated liquids the decrease of internal pressure per 10° rise in temp. is about 2-3 atm., while for associated liquids it is considerably greater. The internal pressure furnishes a measure of the association of a liquid.

R. L. DODGE

Supersaturation of gases in liquids. K. S. WYATT. *Trans. Roy. Soc. Canada* [iii], 18, III, 127(1924).—An aq. soln. of N₂ satd. at a pressure of above 100 atm. at the

ordinary temp. was brought to atm. pressure without the immediate formation of bubbles in the body of the liquid. The phenomenon has not yet been reproduced. B. C. A.

Temperatures of evaporation of water into air. W. H. CARRIER AND D. C. LINDSAY. *Mech. Eng.* 47, 327-31 (1925).—The fundamental equation is $r'(w' - w) = (C_{pa} + C_{pw}) (t - t')$, where r' = latent heat of evapn. per unit wt. of H_2O evapd. at t' , w' = final wt. of vapor per unit wt. of gas, w = initial wt. of vapor per unit wt. of gas, C_{pa} = mean sp. heat of gas between t and t' , C_{pw} = mean sp. heat of water vapor in the same range, t = initial temp. of gas, t' = final temp. of gas, vapor and liquid. Extensive expts. were carried out to test this formula. For air velocities of 200 ft. per sec. or over it is sufficiently accurate for engineering design (actual depression 1-3% less than calcd.). For lower velocities the errors are given by charts. W. L. BADGER

Inelastic atomic and molecular collisions. M. BODENSTEIN. *Z. Elektrochem.* 31, 343-50 (1925).—An interesting review of the field of chemical kinetics and its relation to such problems as the "activation" of mols. The question of the absolute value of " k " (specific reaction rate) is still unsolved and we must look to atomic physics and quantum theory for help. W. ALBERT NOYES, JR.

The equation of state of liquids and solid bodies at high and at low temperatures. J. J. VAN LAAR. *Verslag Akad. Wetenschappen Amsterdam* 33, 957; *Proc. Acad. Sci. Amsterdam* 27, 97-913 (1925).—This equation of state is $p + (a/v^2) = [(RT)/(v - b_0)] [1 + ((b_0 - b_0)/v)] = [(RT)/(v - b_0)] [1 + (2b_0/v)]$, and was first arrived at assuming that, in van der Waals' equation, $b = b_0/[1 + ((b_0 - b_0)/v)]$. The significance of the dependence on the vol. of b is discussed. The equation is confirmed for the following liquids at ordinary temp. by comparing the observed values of the coeff. of compressibility with that calcd. with the aid of the equation, namely, Hg, 22°; ether, 20°; and EtCl. A derivation of the equation is given, based upon the thermodynamic formula $T(d^2p/dv^2)_v = (dc_p/dv)_v$ in connection with Debye's quanta-theoretical expansion into series for L . L is the progressive part of the energy of the mol., and at higher temp. L approaches the value $3/2RT$. This derivation involves no dependence of b on the vol. Attention is called to a "thermodynamic sophism" in certain current proofs that $(dv/dt)_p$ approaches to 0 parallel to c_p . R. H. LOMBARD

The formation of deposits by molecular radiation. J. ESTERMANN. *Z. Elektrochem.* 31, 441-7 (1925); cf. *C. A.* 19, 3211.—Vapor from Cd or Hg, heated in high vacuum, was passed through a series of slits so as to form a uni-directional stream of mols., directed normally against cooled surfaces of glass, Cu or Ag. The temp. of the surface at which deposits ceased to form depends on the metal, and on the material of the surface; this temp. rose when the temp. of the source of vapor was raised, thus increasing both the concn. of vapor and the velocity of the mols. The equil. at the crit. temp. is therefore between condensation and evapn., rather than between adsorption and reflection of mols. from the surface. The heat of adsorption of the metal on the deposit may be calcd. by the Clausius-Clapeyron equation, from the vapor pressure which the deposit must have in order to be in equil. with the known concn. of vapor condensing on it; it comes out from $2/6$ to $1/7$ the heat of evapn. from a solid surface of the metal. B. H. CARROLL

A new method for determining simultaneously the capillary constants and the coefficient of viscosity of viscous liquids. EMMA MÜLLER. *Sitzb. Akad. Wiss. Wien, Math.-nat. Klasse.* 33, 11a, 133-47 (1924).—The liquid to be examd. is introduced into a capillary tube. The liquid is then raised above its equil. position and the velocity with which it flows back is observed. Since the velocity of flow is a function of both the capillary rise and the coeff. of viscosity, these expts. det. both. The app. is thermally insulated and the const. are obtainable at varying temps. The capillary const. are detd. by the eqn. $\alpha = \alpha_0 (1 - \epsilon_1 t - \epsilon_2 t^2)$ (where α is the capillary const.); by means of it the temp. coeffs. for pure glycerol as well as those for glycerol- H_2O mixts. have been detd. ϵ_1 has its smallest value and ϵ_2 its largest value for pure glycerol [0.000862 and 0.00000589, resp.] while for pure water their magnitudes are reversed [0.00219 and 0.00000202, resp.]. The variations of both temp. coeffs. with the different mixts. are governed by the amt. of dissolved substance present. The detailed data for glycerol- H_2O mixts. at temps. from 20° to 90° are included. J. H. PERRY

Variation of the surface tension of liquids under the influence of radiation. A. GRUMBACH AND S. SCHLIVITCH. *Compt. rend.* 183, 241-3 (1925).—By placing a drop of certain liquids in a horizontal capillary tube, and exposing one meniscus to light from a Hg arc, increased surface tension was estd. by the speed of motion toward the light end, which is of the order of 1-2 mm. per hr. Aq. solns. of fluoresceine, Na naphthionate, sulfonyluorene and uranyl nitrate, xylene soln. of anthracene, EtOH soln. of xylene and

gasoline showed the phenomenon. FeCl_3 and $(\text{COOH})_2$ solns. were unaffected.

A. W. FRANCIS

Phase boundary forces at the interface gas liquids. III. Electrical properties of monomolecular layers of insoluble substances. A. FRUMKIN. *Z. physik. Chem.* 116, 485-97(1925); cf. *C. A.* 18, 1934; 19, 1799.—A method based on radioactive principles is described and a drawing of the app. given, for the measurement of p. d. at the surface air | monomol. layer of an insol. substance spread on the surface of acidified water. Measurements are given for heptyl, capryl, capric, lauric, myristic, palmitic, stearic, cerotinic, oleic, elaidic and α -bromostearic acids; ethyl oleate, triolein, tripalmitin; cetyl and myricyl alcohols; stearamide and heptadecylamine on the surface of 0.01 *N* HCl. A measurement is made of heptadecylamine on the surface of 0.0001 *N* HCl and 0.01 *N* NaOH. When the substances were solid at ordinary temps. a petroleum ether soln. was used to obtain the desired layer. The observed effects of the higher members of homologous series can be explained on the basis of the orientation proposed by Langmuir, but the effect per mol. is less than in the lower members. When applied to sol. substances this method yields results which are in agreement with those obtained by Kenrick's method.

R. SCHIERZ

The influence of hydrogen and substituted halogens on the properties of organic compounds, especially on their boiling points. A. E. VAN ARKEL AND H. DE BOER. *Rec. trav. chim.* 44, 675-92(1925).—Data are reviewed showing that in various compds. H shows a variable character ranging all the way from electropositive H to electronegative H, with every kind of intermediate stage. v. A. and de B. have tried to find a phys. property by which this variable nature of H may be expressed numerically. In this paper the b. p. data are examd. in this way. Conclusion: In every group of org. compds. the $\sqrt{\alpha}$ -value per halogen atom is for each halogen proportional to the vol. The values of $\sqrt{\alpha}$ are different in different groups and are smaller the more atoms there are present close to the halogen atom. Although in the methane, ethane and propane series the central atom is so much enveloped by the halogen and H atoms that it cannot act toward the outside, this is not the case with the ethylene-, benzene- and Si-compds. The envelopment of the central atoms becomes more effective the larger the vol. of the surrounding atoms becomes. In this way it becomes comprehensible that C_2H_4 and $\text{Cl-ethylene compds.}$, as well as SiF_4 (to give complexes: H_2SiF_6 , etc.), have good addn. powers, while C_2Cl_4 is preferably formed from satd. Cl_2 by splitting off I, and why SiBr_4 , for instance, shows no inclination to form complexes. F with its at. vol. of 11 shows its relationship with the other halogens. H on the other hand shows an inconstant $\sqrt{\alpha}$ -value. This value is smallest in the hydrocarbons and becomes larger the more halogen is bound with the H to the same C atom. Even the substitution of halogen in other hydrocarbon groups exercises a small influence on the $\sqrt{\alpha}$ -value of H. Multiple bonds also influence the $\sqrt{\alpha}$ -value for H atoms.

E. J. WITZEMANN

Angles of contact and polarity of solid surfaces. N. K. ADAM AND GILBERT JESSOP. *J. Chem. Soc.* 127, 1863-8(1925).—The work of adhesion of a solid-liquid surface was estd. from the equation $W = T_{LV} (1 + \cos \theta)$, where T_{LV} is the surface tension of the liquid and θ is the angle of contact. The angle was detd. by adjusting a glass plate covered with the substance being studied at such an angle in the surface of H_2O that the latter was level right up to the plate, as observed by reflection. The angle was about 100° for paraffin either solidified in air, solidified in H_2O , or scraped; for octadecyl iodide solidified in air or scraped, and for hexadecyl alc. and palmitic, stearic, and eicosanic acids if solidified in air. The latter compds. showed much lower angles if scraped and slightly lower angles if flakes of crystals from a solvent were used, because of the exposure of polar groups.

A. W. FRANCIS

The practice and colloid-chemical evaluation of the oil drop-water experiment. O. OHRMANN. *Z. physik. chem. Unterrichts* 38, 36-7(1925).—O. recommends a mixt. of 2% phenol in olive oil which he finds to be very satisfactory for the demonstration of the spreading of a drop of oil on a water surface.

M. BRER

The distribution of surface active materials between water and organic solvents. R. G. SCHULZ. *Kolloidchem. Beihefte* 21, 37-54(1925).—At the interface between 2 liquids the same relations hold true between surface activity and partition of a solute between the liquids as are found for the liquid-solid interface, i. e., for the adsorption of a solute from soln. by a solid adsorbent. The distribution of a solute between H_2O and an immiscible org. liquid depends upon the relation between (A) a force of attraction between solute and H_2O and (B) a force of attraction between solute and org. liquid. (1) If A is large and B small there will be no partition—examples, EtOH and HOAc. (2) If A is small and B large the solute will be completely removed from the H_2O —

examples, octyl alc. and caprylic acid. (3) If A and B are not too dissimilar in magnitude there will be a partition of the solute between H_2O and the org. liquid which will favor accumulation in the org. liquid in proportion as the solute is more surface active—examples, butyl alc. and butyric acid. In case (3) the solute can be completely extracted by the org. liquid if a large enough amt. is employed unless A is especially high.

F. L. BROWNE

Kinetic theory of surface films. I. Surfaces of solutions. R. K. SCHOFIELD AND E. K. RIDEAL. *Proc. Roy. Soc. (London)* 109A, 57-77 (1925).—A correct application of Gibb's equation to the surface tension-concn. curves for aq. solns. of a no. of capillary active org. substances supports the idea of the unimol. character of the adsorbed film. The views of Traube relating surface tension to osmotic pressure is examd. and a modification, $F(A-B) = xRT$, analogous to that of Amagat's eqn. for highly compressed gases, is suggested. In this eqn., F is the surface tension, A the area occupied by 1 g. mol. of the active substance at the interface, B the limiting area of a g. mol. under high compression and $1/x$ is a measure of the lateral mol. cohesion. This equation fits existing data for H_2O -air, H_2O - C_6H_6 , and H_2O -Hg interfaces and gives values for $1/x$ in agreement with those anticipated. The value of B for H_2O -air and H_2O - C_6H_6 interfaces is common for normal fatty acids, thus supporting Langmuir's orientation hypothesis. The lateral mol. cohesion increases with the length of the hydrocarbon chain. Sucrose mols. do not cohere at a H_2O -Hg interface. The view that the effect of capillary active substances on surface tension is due to thermal agitation alone, is supported.

ARTHUR GROLLMAN

The action of colloidal and semicolloidal iron oxide on aqueous solutions of gelatin. R. WINTGEN AND E. MEYER. *Kolloid-Z., Special No.*, April 1, 1925, 369-79.—Fe oxide hydrosols were prepd. as follows: (1) A soln. of NH_3 was slowly added in small portions with stirring to a soln. of 50 g. of hydrated $FeCl_3$ until the Fe hydroxide formed was not dissolved after several hrs. Any ppt. was filtered out. The hydrosol was dialyzed by the method of Neidle (cf. *C. A.* 10, 1957) for 50 hrs. at 70-80°. (2) The method of the German Pharm. similar to (1) was used but the sol was dialyzed 30 hrs. (3) Prepd. same as (2) but dialyzed 7 days by the method of Zsigmondy and Heyer (cf. *C. A.* 5, 821). (4) The com. product from Cehc & Co. contained 3.796% Fe content. (5) Prepd. as (1) but dialyzed in the cold. The sols (1), (2), (3) and (5) were dild. to 1.5% Fe content. By analysis sols (1) to (5) contained for 1 g. atom of Fe, resp., 0.1382, 0.1981, 0.2365, 1.148, 1.461 g. atoms of Cl. Weighed quantities of electrolyte-free gelatin were allowed to swell in cold H_2O for 5 hrs., then dissolved in H_2O at 60-70°, dild. to a 5% soln. and protected from decompn. by a little thymol. The pptns. at 25° were arranged so that in a series of test glasses contg. in each a final vol. of 18 cc.: (1) (a) increasing amts. of the gel sol dild. with H_2O were added to a const. amt. of Fe oxide sol or (b) a const. amt. of the Fe oxide sol was added to increasing amts. of gel sol dild. with H_2O ; (II) (a) increasing amts. of gel sol were added to a const. amt. of Fe oxide sol dild. with H_2O or (b) a const. amt. of Fe oxide sol dild. with H_2O was added to increasing amts. of gel sol. For (I) the quantity of ppt. increased with increasing amts. of gelatin to a const. value. For (II) with increasing amts. of gelatin, the quantity of ppt. rose to a max., then decreased to 0 and finally increased again (cf. Zsigmondy and Joel, *C. A.* 19, 764). The min. for the different sols used in (II) occurred at 6.2 cc. of sol (1); 6.5 cc. of sol (2); 6.6 cc. of sol (3); 4.2 cc. of sol (4); 3.8 cc. of sol (5). With the typical colloids, sols (4) and (5), the quantity of gelatin necessary to start pptn. of the Fe oxide sol decreased in a linear relation with the dildn. of the Fe oxide sol; but with the semicolloids, sols (1) and (2), the quantity of gelatin increased at first and produced curves (not linear). The relation between the quantity of gelatin necessary to start pptn. and the concn. of the Fe oxide sol was reversed—linear with the sols (4) and (5), and curved with sols (1) and (2).

H. M. McLAUGHLIN

Protective action of soaps and further evidence in favor of the chemical theory of adsorption. III. S. S. BHATNAGAR, MATA PRASAD AND D. C. BAJAJ. *Quart. J. Indian Chem. Soc.* 2, 11-22 (1925).—The protection of colloidal solns. by soap soln. was studied with As hydrosulfide, Sb hydrosulfide, Cd hydrosulfide, in colloidal soln. and ZnO , MnO_2 , Al_2O_3 , PbO_2 , fuller's earth, $BaCO_3$ and $PbCl_2$ as solid adsorbents. The investigation was made by the use of Doonan's drop pipet and the no. of drops in a given vol. of soap soln. was counted under standard conditions. The drop nos. increase with increase in soap concn. and the surface tension decreases as the soap concn. increases. The drop nos. of the colloidal solns. were detd. likewise; and it was shown that the colloids do not take any part in altering the surface tension of the dispersing medium. The colloidal solns. were mixed with the soap solns. of different concns. and allowed to stand 24 hrs. The no. of drops in the same vol. of the mixed solns. was counted and

the concns. of the soap after adsorption were detd. The quantity of soap adsorbed per 100 cc. of soln. was then calcd. The observed concn. of the soap is not as is expected on mixt. law but is in all cases less. The diminution in concn. is due to the absorption of soap mols. by the particles of colloidal solns. The same conclusion can be drawn from the expts. made on fine powders. The adsorbed soap loses its well-known property of dissolving in water and lowering the surface tension and thus supports the chemical theory of adsorption. 14 tables are given. E. SCHERUBEL.

The adsorption of gases by graphitic carbon. H. H. LOWRY AND S. O. MORGAN. *J. Phys. Chem.* **29**, 1105-15 (1925); cf. *C. A.* **18**, 2094.—Graphites of different adsorptive capacity, as follows: Carbon graphite, previously treated with HF to reduce

The "graphitic acids" were -----
Adsorption data for CO₂ at 0, 35, 56.7, 80.4, 100°; for N₂ at 0, 56.7, 100°; and for H₂ at -191° and at pressures up to 1 atm. are given. While graphite from the "graphitic acid" which was least oxidized absorbed the least gas, there was no quantitative proportionality between the degree of oxidation and the amt. of gas adsorbed. The graphite showing the highest adsorptive capacity adsorbed 1.5 to 1.7, the amt. of N₂ at 100° and 760 mm. pressure that the best adsorptive charcoal will adsorb. The data are in general agreement with the hypothesis that any treatment which will increase the ratio of surface to mass or the degree of unsatn. of the at. forces of a solid adsorbent, or both, will increase its adsorptive capacity. F. L. BROWNE.

The adsorption of hydrogen iodide gas by glass surfaces. E. MOLES AND R. MIRAVALLS. *Anales soc. españ. fis. quim.* **23**, 223-30 (1925).—The wt. of HI gas adsorbed by the walls of glass bulbs, which had been used for the detg. of the d. of HI gas, was detd. by 2 methods: (1) bulbs whose walls were satd. with HI gas as a result of prolonged usage were thoroughly washed with H₂O and the I⁻ was pptd. therefrom with AgNO₃; (2) the same bulbs were cleaned with H₂SO₄ + K₂Cr₂O₇, washed, dried, evacuated to 0.005 mm. and weighed. They then stood 72-96 hrs. filled with HI gas at 760 + mm., were evacuated to 0.4-0.6 mm. and weighed. The increase in wt. was less than that calcd. from the pressure of the HI gas in the bulb because of the displacement of adsorbed H₂O by the HI. The bulbs were filled again with HI and evacuated as before, after which the observed increase in wt. was greater than that calcd. from the pressure of the contained gas, because of the adsorption of HI. The wt. of HI absorbed, calcd. per l., was: Bulb N-4, vol. 750 cc., (1) 1.97×10^{-3} g., (2) 1.99 and 1.83×10^{-3} g.; bulb N-2, vol. 608 cc., (1) 2.12×10^{-3} g., (2) 1.98 and 2.21×10^{-3} g. It is calcd. that this amt. of HI might form a layer on the glass 30-35 mol. thick. This anomalous result is attributed to there being capillary condensation, and chem. reaction between the gas and the glass, in addn. to the true adsorption. R. H. LOMBARD.

The adsorption properties and particle size of several lampblacks in organic liquids and in crude rubber mixtures as well as the effect of these lampblacks on the properties of vulcanized products. M. LEBLANC, M. KROEGER AND G. KLOZ. *Kolloidchem. Beihefte* **20**, 356-411 (1925).—Using a no. of com. lampblacks of German and American origin, the authors sought to detect any possible relation between the properties of a lampblack and its behavior in its mixt. with rubber. The work coned. on a study of (1) the general characteristics of the lampblack as such, (2) of mixts. of lampblack with crude rubber, (3) of rubber-lampblack-benzene sols vulcanized in the cold, and (4) of hot vulcanized rubber contg. varying amts. of lampblack admixed. **Conclusions.**—It is impossible to predict the properties of rubber-lampblack mixts. from a study of the crude lampblack. The sedimentation phenomena observed for lampblack dispersed in org. liquids are dependent upon various factors. Thus, the time of sedimentation for different makes of lampblack varies with the liquid used and also with the time of exposure to one and the same liquid. Lampblack suspended in an org. medium does not show any adsorptive capacity for S, I or mercaptans. The sorptive capacity for water vapor, as well as the sp. vol. detd. by shaking with a liquid, shows irregularities which may be traced back to the ash content and the content of extractives. The different lampblacks have different effects upon crude and vulcanized rubbers. The tensile strength and resistance to wear of vulcanized rubber increase with the addn. of lampblack. A certain relation exists between the effect of the individual lampblacks and their particle size and adsorptive characteristics, which can be judged from the tendency for crude rubber-lampblack mixts. to become dispersed in benzene and by detn. of the viscosity of the benzene sols. Dispersion takes place very readily with an inferior lampblack, more difficultly with a good grade. High viscosity of the sol corresponds to a good lamp-

black, and *vice versa*. A parallelism exists between these viscosity detns. and the effect of the various lampblacks upon the resistance to wear of vulcanized material, while the parallelism is not quite complete for the tension series. The degree of dispersion of lampblack in the crude rubber-lampblack-benzene sols varies considerably for the different lampblacks. A high degree of dispersion is necessary, but not sufficient, for the development of great adsorptive power. Marked differences are observed in the rate at which gels of equal elasticity are formed by vulcanization of the gel in the cold. These differences may be traced back to variations in the degree of aggregation of the rubber particles as is shown by the effect of the lampblacks in the milling. The disaggregating effect increases with decreasing size of the lampblack particles.

PER K. FRÖLICH

The influence of the salt content on the adsorptive power of active charcoal, as well as a review of the principal characteristics of the most important technically prepared active charcoals. HEINRICH HERBST. *Kolloidchem. Beihefte* 21, 1-36(1925).—The service time of active charcoal, impregnated with varying amts. of KOH, K_2CO_3 , or their solns. in H_2O was detd. against CCl_3NO_2 , Cl_2 , $COCl_2$ and HCN. For charcoal and KOH the service time toward CCl_3NO_2 decreases as the amt. of KOH increases, becoming 0 at 50% KOH. Toward $COCl_2$ the service time increases markedly up to 25% KOH and then falls off again. Toward Cl_2 and HCN the service time increases rapidly with KOH content up to 12% and then remains nearly const. When H_2O is present in addn. to KOH, the increase in service time toward $COCl_2$, Cl_2 and HCN is much more marked and there is no falling off after reaching a max. Charcoal impregnated with H_2O or K_2CO_3 solns. shows a decrease in service time proportional to the total wt. of H_2O plus K_2CO_3 added. The presence of H_2O in the charcoal decreases the service time toward HCN slightly, but impregnation with K_2CO_3 soln. gives a marked increase. Toward $COCl_2$, H_2O up to 30% and K_2CO_3 solns. up to 50% increase the service time markedly, but further amts. cause it to fall off exceedingly rapidly. Toward Cl_2 , H_2O and K_2CO_3 increase the service time in proportion to the amt. added. It is concluded that charcoal is most effective in purely adsorptive processes when free from H_2O or impregnating compds. and that the activity is decreased in proportion to the amt. of H_2O or compds. present. Where "secondary catalytic reactions" are involved, impregnation with dry salts up to 15-20% increases the effectiveness, after which further impregnation causes it to fall off again, but impregnating with H_2O or salt solns. up to 50-60% increases the effectiveness. The adsorptive characteristics both for gases and for aq. solns. of a number of commercial charcoals are described. The total amt. of substance that a charcoal will absorb, or its activity, depends upon the purity of the C and the ultraporosity and in general is directly proportional to the apparent d. The velocity of adsorption is roughly inversely proportional to the cube of the apparent d.

F. L. BROWNE

Adsorption. XI. Influence of ions carrying the same charge as the sol on the coagulation of sols of (1) Prussian blue and of (2) positive ferric hydroxide. S. GHOSH AND N. R. DHAR. *J. Phys. Chem.* 29, 659-78(1925); cf. *C. A.* 19, 3046.—Continuation of the investigations on Prussian blue and hydrous Fe_2O_3 sols indicate that abnormal behavior on diln., abnormality toward mixt. of electrolytes and the phenomenon of acclimatization are essentially connected and go hand in hand. Smaller quantities of KCl and KNO_3 are required when Prussian blue is coagulated in the presence of HCl or HNO_3 . This is due to the cutting down of the hydrolysis of Prussian blue and the consequent formation of the stabilizing ferrocyanide ion. The influence of several non-electrolytes on the coagulation of As_2S_3 and Sb_2S_3 was investigated but no explanation of the results was offered.

HARRY B. WEISER

Soaps and the theory of colloids. J. W. MCBAIN. *Proc. Roy. Inst. Gl. Britain* March 20, 1925, 6 pp.; cf. *C. A.* 19, 741.—A brief review of the bearing of the studies of soap solns. carried out by McB. and his co-workers on the general theory of colloids.

F. L. BROWNE

The protective effect of soap on gold hydrosol prepared by the method of Zsigmondy. B. PAPAConstantinou. *Kolloid-Z., Special No.*, Apr. 1, 1925, p. 329-33.—The relationship between the emulsifying power of soap and its value in washing is close. By Zsigmondy's method Au sols with reproducible properties may be made. Soap solns. whose concn. was 0.1-0.2% were used. As the size of the colloidal Au particles increased the protective effect of the soaps decreased. When the temp. was raised the protective action increased. The alkyl has a great effect on the protective action of soaps. Increasing alkyl reduces protective action. Increasing concn. of electrolyte produces decreasing protective action. Soaps of lauric, of myristic and of palmitic acids have equal effects whether Na or K replaces H. K-soaps of stearic and of linoleic acid are

more effective than Na-soaps, at higher temps. Na oleate is more effective than K oleate. At room temp. the Au no. increases in order as the soap is made from the acids, oleic, palmitic, stearic, myristic and lauric. If it could be shown that these adsorbability series were independent of the chem. nature of the colloid particle, such expts. could predict the effectiveness of soap in washing. F. E. BROWN

The surface concentration of sodium oleate and of colloidal sulfur. J. M. JOHLIN.

sodium oleate sols. of 1.0 to 0.0001 % concn. was measured. In the case of true sols. the change with time was exceedingly rapid but took place according to the equation previously given. Alkali added to 0.1% sols. was found to cause a decreasing irregularity as the amt. of alkali was increased until the change with time fluctuated periodically up and down. Alkali was found to cause a decreased tendency to foam. The change of surface tension with time in a regular manner according to the given equation only takes place in the case of colloidal sols. in which the solute is highly dispersed in a manner similar to that of true sols. The surface tension of colloidal S sols. will under certain conditions change with time according to the given equation. No other inorg. colloid was found to behave similarly. This behavior cannot be reconciled with the assumption stated above and it cannot be said to what extent the phenomenon is due to the presence of pentathionic acid. F. L. BROWNE

General method for the exact investigation of diffusion phenomena in gels. R. FRICKE. *Z. Elektrochem.* **31**, 430-45 (1925).—The gel, contained in a glass tube, is kept in contact at one end with a large vol. of soln., maintained at const. temp. and concn. by continuous stirring. A microlome is described by which the gel is cut into fine slices which are analyzed microchemically. Results are given for the diffusion of NaCl in agar. ARTHUR GROLLMAN

The silicic acid sol. II. R. KRUYT and J. POSTMA. *Rec. trav. chim.* **44**, 765-89 (1925) (in English).—The silicic acid sols were prepd by pouring a soln. of silicate into HCl and then dialyzing. All sols obtained in this way appeared, from cataphoresis detns., to move towards the anode, i. e., to be negatively charged. The law of Poiseuille holds for the silica sol at 20°. The sols are more stable at room temp. than at higher temps. The shorter the time of dialysis of a sol, the greater is its increase in viscosity with the time. From this it is concluded that as a rule the time of flow of a sol increases from the time of its formation. An exception to this rule is made by a small group of sols. There are 2 groups of silicic acid sols. The 1st group, which is the most common, has an increasing relative viscosity with the time and a pH of ≈ 4.5 . Sols of the 2nd group seldom occur directly by dialysis; they have a relative viscosity which decreases directly with the time and a pH of about 6 or higher. The reason for the occurrence of these sols must be looked for in the occlusion of silicate. By adding HCl to a sol of the 2nd type it may be changed into one of the 1st type if enough is added to reduce the pH to 4.5 or less. Conversely the addn. of enough NaOH soln. to a sol of the 1st type changes it into a sol of the 2nd type. Na silicate sols. can also bring about this change. In general Na silicate has the same effect on a sol as NaOH of the same normality. If HCl is poured into a sol with increasing viscosity, this increase remains in existence. The negative charge is first removed. If still more HCl is added the sol becomes positively charged. Salt sols. discharge the sols and cause a rapid increase in viscosity and finally gelation or flocculation. The discharge of the sols by HCl and by salt sols. is evident from the disappearance of von Smoluchowski's electroviscous effect, by which the initial relative viscosity is lowered on the addn. of electrolytes. Conversely an increase of this initial viscosity took place on addn. of NaOH or Na silicate on account of a greater electroviscous effect due to a higher negative charge. The final viscosity was considerably lowered by the addn. of 50% H_2O to the sols. On account of the diln. changes in the viscosity of 50% aq. sols on standing are extremely small. The addn. of EtOH probably has a slight dehydrating action on the sols, judging from the detns. of viscosity. Silica sols take up OH ions and Cl ions. The disappearance of a great no. of OH ions on the addn. of NaOH or Na silicate can be established by pH detns. On warming the sols with Cl-free HNO_3 Cl is set free which could not be detected before this treatment. This shows that the sol particles had first fixed Cl. Apparently silicic acid particles have the power of filling themselves like a sponge, with OH and Cl ions. E. J. WITZMANN

Effect of colloids in the displacement of lead and copper from their salts by zinc. L. T. M. GRAY. *J. Chem. Soc.* **127**, 776-80 (1925).—The crystals of Pb which deposit on thin Zn foil dipped in $Pb(AcO)_2$ soln. contg. gelatin changed steadily from very small needles to small nodules of increasing size as the gelatin content increased from 0 to 0.3 to 0.4%. When this proportion of gelatin was reached, the size of the nodules diminished and the

nodular structure was replaced by a branched structure, the deposit closely resembling the original small needles. A max. for grittiness and size of particles was also found with glue, but not with gum arabic. Similar results were obtained for Cu. The colloids cause a decrease in crystal size and in cohesive power. With Pb the size of the component crystals diminishes fairly steadily throughout; but the cohesive power, by which they form larger aggregates, increases to a certain point and then decreases. With Cu the decrease in crystal size is the detg. factor. The poor deposit with higher concns. of colloid results from the higher proportion of adsorbed colloid. HARRY B. WEISER

Spontaneous structure formation in sols; a new kind of anisotropic liquid media. H. ZOCHER. *Z. anorg. allgem. Chem.* 147, 91-110(1925).—Upon cooling hot, concd. solns. of benzopurpurin 4B and chrysophenin sols long colloid particles arranged in parallel order were observed. In old V_2O_5 and $Fe(OH)_3$ sols of suitable concn. anisotropic colloid particles with parallel orientation gather in high concn. The Brownian movement is still present in such sols as a brisk oscillation about an equil. position. Vigorous agitation causes the structure to vanish completely. In the course of time it forms again provided that coagulation, in its narrow sense, does not set in. In V_2O_5 sols the rod-shaped particles stand with reference to each other with two sides parallel, clinging together at the edges and stretching out in fan-shapes from the ends. In $Fe(OH)_3$ sol the disc-shaped particles lie with their rims close together in large sheets. These sheets are equidistant from one another, resulting in recurring lamellae with spacing equal to a wave length of light and producing a strong play of colors. In the magnetic field these strata systems become anisotropic in the direction of the strata and reflect polarized light. The elec. field alters the spacing of the strata. Mech. motion acts like the magnetic field. Temp. changes have no important influence.

F. L. BROWNE

* **Titania jellies.** SIMON KLOSKY AND CHRISTOPHER MARZANO. *J. Phys. Chem.* 29, 1125-8(1925).— Na_2TiO_3 was dissolved in 35% HCl and the acid neutralized by the dropwise addn. of K_2CO_3 , Na_2CO_3 or $(NH_4)_2CO_3$. Vibrant jellies were obtained similar to SiO_2 jellies. By adding $FeCl_3$ to the acid titanate soln. jellies of TiO_2 and Fe_2O_3 result.

F. L. BROWNE

Contribution to general colloid chemistry. XIV. The constitution and stability of ferric oxide sols. IV. N. KÜHNEL AND WOLFGANG PAULI. *Kolloidchem. Beihefte* 32, 319-37(1925).—A study of the arrangements of the mols. and complexes in the particles of Fe_2O_3 sols prepd. by peptization. These sols and similar sols prepd. by hydrolysis exhibit marked differences in ionogenic character, a phenomenon which is made the subject of extensive discussions. **XV. The structure of hetero-peptides 1. (Al-Fe)-oxide sols.** *Ibid* 338-55.—Mixed sols consisting of Al-oxide and Fe-oxide are prepd. by peptization. The mechanism of the peptizing process and the ionogenic characteristics of the resulting complexes are studied. A discussion of the possible distribution of the 2 components is included and it is suggested that the individual particles of the heterogeneous sol may be regarded as mixed crystals. PER K. FRÖLICH

General colloid chemistry. XVI. The constitution of silicic acid sols. 1. W. PAULI AND E. VALKO. *Kolloid-Z.*, Special No., Apr. 1, 1925, 334-40; cf. preceding abstract.—The electrochem. properties of silicic acid have been studied to obtain an insight into the constitution of the sols and to establish the dependence of these properties upon the stability of silicic acid sols. Sols were prepd.: (1) from Na_2SiO_3 according to Graham, (2) by sapon. of the Me ester of silicic acid and (3) by decompn. of $SiCl_4$. With continued dialysis of silicic acid sols prepd. by (1) a const. value for cond. was attained which showed that the sols themselves possessed a relatively considerable cond. The constitution of the sol particles could be expressed by $x(SiO_2 + nH_2O).ySiO_3H^- + yH^+$ or (yNa^+) . The values for the ratio $x:y$ which represents the no. of neutral SiO_2 mols. per unit charge were between 320 and 1200. The cations H and Na contained in the sols after simple dialysis were interchangeable. With the help of electrodialysis (cf. C. A. 19, 1431) stable, pure sols were produced. Electrodialysis was also used to prep. highly concd. sols out of dil. sols. H* M. McLAUGHLIN

The peptization of bismuth hydroxide. A. KUHN* AND H. PIRSCH. *Kolloid-Z.* Special No., Apr. 1, 1925, 310-8.—When $Bi(OH)_3$ is pptd. by adding drop by drop with const. stirring 50 cc. of concd. NH_4OH to 100 cc. of acidified 0.1 N $Bi(NO_3)_3$, $Bi(OH)_3$ uncontaminated with basic salts is pptd. When this ppt. is centrifuged and washed by decantation 3 or 4 times, it becomes colloidal. The ppt. may be peptized also by dialysis. When the cond. falls to 2×10^{-4} peptization begins. The concn. of Bi present as a sol increases as the cond. decreases. A sol contained 2.14 g. of Bi per l. when first made, 1.9 g. after 3 days and 0 g. after 7 days. The addn. of raw sugar, mannitol, lactose or glycerol did not increase the stability of the sol. $Bi(OH)_3$ sols

are better peptized when the NH_4OH is added suddenly than when it is added gradually, and a concn. of 0.1 is better than 0.01 for the $\text{Bi}(\text{NO}_3)_3$. It is more difficult to peptize the ppt. after it has stood in contact with its supernatant liquid. When the ppt. was washed 3 times after centrifuging it peptized more readily than when washed more or less. Raw sugar and mannose peptize best at a concn. of 0.05. Lactose and glycerol have no max. The amt. of Bi in suspension per l. increased with increasing concn. as far as the expts. were carried: 46% for glycerol, and 0.01 M for lactose. At a concn. of 0.01 M , lactose was keeping 2 g. of Bi per l. in colloidal form. The action of sucrose and mannose seemed to be merely peptization, while that of lactose and sugar was based on a chem. process.

F. E. BROWN

The theory of Liesegang rings. WO. OSTWALD. *Kolloid-Z.*, Special No., Apr. 1, 1925, 380-90; cf. Popp, *C. A.* 19, 2432.—The proposed "Diffusion Wave Theory" of Liesegang rings refers only to rhythmic pptns. resulting from chem. reactions in which the components diffuse towards one another. It is based on the following ideas: (a) in all reactions systems which produce typical rhythmic pptns., at least 3 principal diffusion waves are formed and interfere. (b) many, perhaps, all typically rhythmic, pptn. reactions belong in the sense of the mass action law to the so-called "limited" reactions, *e. g.*, in contrast with such reactions as the pptn. of BaSO_4 , they are incomplete. The diffusion of NH_4OH into a gel contg. MgCl_2 is discussed in detail and considered typical of a series of reactions, including $\text{AgNO}_3 + \text{K}_2\text{Cr}_2\text{O}_7$, $\text{Pb}(\text{NO}_3)_2 + \text{KI}$, etc. At first the diffusion wave of the NH_4OH into the gel is retarded by the formation of $\text{Mg}(\text{OH})_2$, which keeps the concn. and the diffusion gradient of the NH_4OH in the gel small. The MgCl_2 sets up a diffusion wave towards the NH_4OH , *i. e.*, region of lowest concn. At the same time the diffusion gradient of the reaction electrolyte increases rapidly ($2\text{NH}_4\text{Cl}$ is formed per MgCl_2). The NH_4Cl diffuses (wave spreads) in opposite directions from a max. concn. where the concn. of the NH_4OH and the MgCl_2 is kept so small that the pptn. of $\text{Mg}(\text{OH})_2$ is prevented in accord with the mass action law. The following exptl. observations are mentioned in support of the theory: (1) all rhythmic pptns. dissolve in an excess of the reaction electrolyte, *e. g.*, the rings of $\text{Mg}(\text{OH})_2$ are dissolved successively by the diffusion of an excess of NH_4Cl into the gel. (2) Previous addn. of the reaction electrolyte to the gel changed the width of and the distance between the rings. Continuous pptns. were decomposed into rings (*e. g.*, adding 0.1-0.15 N $(\text{NH}_4)_2\text{SO}_4$ to 0.05 N CoSO_4 in a 3% gel before allowing 2 N NH_4OH to diffuse into the gel) and inversely rings disappeared by the extension of the initial pptns. (*e. g.*, adding NH_4Cl to a gel contg. MnCl_2 before the NH_4OH enters by diffusion). (3) When one component was varied in the sense of the mass law, the pptn. became continuous (*e. g.*, diffusing NaOH or KOH instead of NH_4OH into a gel contg. MgCl_2). (4) Metastable limits, peptization and coagulation, adsorption on pptns., etc., are not considered fundamental conditions for rhythmic pptns. These and other phenomena are secondary factors insofar as they influence the form, position and velocity of the diffusion wave as well as the conditions for pptn. in the sense of the mass action law.

H. M. McLAUGHLIN

Dispersion and the interchange (ionic) of bases. G. WIEGNER. *Kolloid-Z.*, Special No., April 1, 1925, 341-69; cf. *C. A.* 6, 2477, 3304.—Expts. have been undertaken to show the importance of the interchange of bases for coagulation, hydration and imbibition of clay ultramicros and to det. to what extent this ionic interchange enters into the dispersion equil. of clays and the general importance of this for dispersoid chemistry. When the ultramicros of the clay are dissociated into ions the highly complex anion of the silicic acid is held by the unsatd. forces of the Al atom on the surface of the clay with the dehydrated complexes already in the ultramicron (cf. Fajans and Beckerath, *C. A.* 15, 2223). On the surface of the clay ultramicron the anions (OH^- or silicic acid) are held more firmly by the unsatd. lattice forces of the Al atom than the cations—especially easily hydrated ions, such as K^+ , Na^+ and Ca^{++} —are held by the weak residual forces of the silicic acid mols. Each particle is considered similar to a spherical condenser with an outer, dynamic, ionic covering more or less loosely held by forces dependent on the nature of the surface. This outer shell, from electrostatic considerations, would be opposite to an inner layer of oppositely charged ions. The potential of the particle would vary in accord with the laws of spherical condensers. The critical potential below which coagulation would occur varies with the nature and valence of the cations which constitute the outer layer.

For Cs^+ and K^+ the strongly hydrated Li ion in the outer layer must have a higher potential and a greater stability than a Cs clay contg. the less hydrated Cs^+ in the more dense outer layer. The following series of clays is arranged in the order of

their increasing stability: (a) univalent cations: H, Cs, Rb, K, Na, Li; (b) bivalent cations: Ba, Sr, Ca, Mg. The addn. of electrolytes to the dispersion medium causes a new arrangement of the ions, first in the outer layer. The little hydrated Cs^+ added to a Li clay strongly enters into the outer layer and rapidly decreases the potential below its crit. point for coagulation. The highly hydrated Li ion added to a Cs clay does not enter into the outer layer so easily and a relatively large quantity of Li ion is required before the crit. potential is reached. This ionic interchange always increases or decreases the coagulation according to the position of the ions in the hydration series. On the other hand the stability of the colloidal systems is limited primarily by the nature of the ions in the outer layer. Ultramicros contg. highly hydrated ions were, in pure H_2O , voluminous, slimy and viscous. Those contg. less hydrated ions around the primary particles were less viscous and more granular. Calcs. of the potential of clay particles from data by Mattson (cf. *C. A.* 16, 2003) indicated that the particles may be dispersed into primary of about 7μ diam. and secondary particles. The latter are formed by agglomeration which is limited by the electrolyte content of the entire system. The surface of the primary particles participates in cation exchange in accord with the same laws as that of the secondary. The exchange of bases det. the potential of the secondary particles and by it the stability of the entire system. Pure Na, NH_4 , K and Ca clays treated with solns. of KCl or CaCl_2 were the more stable, the greater was the hydration of the cations in the outer shell. Viscosity was, in general, higher for coagulations of clays contg. highly hydrated stabilizers. When slightly hydrated ions were used for coagulating clays with strongly hydrated inner ions (e. g., CsCl for a Na clay) an especially voluminous aggregate formed which showed high viscosity. The use of highly hydrated ions to coagulate clays contg. little hydrated inner ions (e. g., LiCl for a K clay) formed less voluminous ultramicros with low viscosity. Schulze's valence rule did not hold. The time required for the coagulation of a dispersion contg. 32 g. of Ca clay per l. with 0.001 *N* solns. of KCl and of CaCl_2 was, resp., 11 and 10 min.; but when 8 g. of Ca clay per l. were present the time required was, resp., 95 and 32 min. For the following wts. of K clay per l. coagulated with 0.005 *N* solns. of CaCl_2 and of KCl the time required was, resp.: 42.2 g., 4 and 13 min.; 21.1 g., 2 and 16 min.; 10.5 g., 5 and 20 min., 5.28 g., 9 and 32 min.; 1.3 g., 35 and 98 min. Similar relations have been found with other sols, such as S and V_2O_5 (cf. Gessner, *C. A.* 19, 4).

H. M. McLAUGHLIN

The use of tap water as the outer liquid in dialysis. ERNST WILKE-DÖRFURT AND MARTA DEKER. *Kolloid-Z., Spec. No.*, Apr. 1, 1925, 305-10; cf. *C. A.* 17, 1737.—Colloidal SiO_2 was prepd. by treating SiCl_4 with H_2O . It was dialyzed in parchment paper, using a rapid dialyzer (cf. *C. A.* 16, 3236). One l. of this sol contained 3.525 g. of SiO_2 . It was dialyzed until no ppt. formed with AgNO_3 (60 hrs.). This pure sol was dialyzed with tap H_2O for 56 hrs. An analysis showed that 1.28% of the solids was CaO. Further dialysis with distd. H_2O removed the CaO so that in 64 hrs. no weighable amt. of Ca was present, and in 168 hrs. the spectrum of the sol had no Ca-lines. During these expts. the flow of the outer liquid was 3 l. per hr. When this rate was doubled the Ca was completely removed in 90 hrs. The distd. H_2O necessary to remove the Ca was greater than that necessary to remove the HCl originally present. However, when a sol contg. 0.81% SiO_2 was dialyzed 4 hrs. with tap H_2O 79.74% of the Cl ions were removed and 0.57% of the solid was CaO. The tap H_2O was replaced by distd. H_2O and the dialysis continued for 8 hrs. more. At the end of this time all of both Cl and Ca was removed. If the tap H_2O contains Fe it cannot be used because the Fe which enters the sol is subject to hydrolysis and produces $\text{Fe}(\text{OH})_3$ sol, which cannot be removed by dialysis.

F. E. BROWN

The significance of the hydrogen-ion concentration in the swelling of gelatin. WO. OSTWALD, A. KUHN AND E. BÖHME. *Kolloidchem. Beihefte* 20, 412-33 (1925).—The swelling of gelatin as a function of p_{H} value is studied for various acids and buffer solns. The observations are discussed in view of the results obtained and predicted by Loeb (Proteins and the Theory of Colloidal Behavior, New York, 1922), from which they differ in several respects: In spite of constancy in concn. and p_{H} , monobasic acids do not cause the same degree of swelling; with HI the swelling is several times greater than with HCl. The H_2SO_4 swelling may exceed that of HCl, contrary to Loeb's rule. A very pronounced effect of the anion on the acid swelling of gelatin is ascertained, thus reviving the classical ion-series of Hofmann. In general, mixts. of acids and salts decrease the swelling as compared with the pure acids of same p_{H} . However, certain anions have such a marked effect that buffer solns. contg. them may cause the gelatin to swell even more than it does in the pure acid of same p_{H} . The isoelec. point of gelatin is not a const.; it varies for different brands of gelatin and is influenced by buffer solns.

This observation is said to account for discrepancies among previous authors in the detn. of the *iso-elec. points of proteins*.
 PER K. FRÖLICH

Studies of the optical activity of gelatin systems. E. O. KRAEMER AND J. R. FANSELOW. *J. Phys. Chem.* **29**, 1169-77(1925); cf. C. A. **19**, 1369.—The optical rotation of systems of Eastman's de-ashed gelatin was studied for p_L between 2.30 and 12.31, and for temps. between 10° and 50°. The relative light scattering capacities (or Tyndall effects) of the same systems were detd. The various hypotheses involving gel forms or sol forms or tautomeric changes which have been proposed from time to time to explain certain behaviors of gelatin systems, including optical activity, lack exptl. support, and are probably confusing rather than helpful. Many of the phenomena which have given rise to the speculations mentioned are due to the fact that gelatin sols and gels display the characteristics of polyphasic (colloidal) systems. The so-called mutarotation of gelatin systems reflects colloidal changes in the systems tending to gel formation. Influences which prevent gel formation also prevent mutarotation. F. L. BROWNE

Electro-ultrafiltration of gelatin and glue. H. BECHHOLD AND A. ROSENBERG. *Biochem. Z.* **157**, 85-97(1925).—Gelatin and glue are purified by a process of electro-ultrafiltration which combines the use of the ultra-filter with the electroglyzer. The method may be applied to other disperse systetis. Instead of the soln. of dispersoid becoming diluted, it is concd. A double filtration method is also described.

W. D. LANGLEY

The action of ozone on aqueous colloidal solutions of inorganic substances. E. H. RIESENFELD AND W. HAASE. *Z. anorg. allgem. Chem.* **147**, 188-95(1925).—Ozone rapidly dissolves Ag sol with the formation of AgOH. From Hg sol Hg₂O is pptd. Au sol is only partially dissolved; the red color changes to blue in consequence of salt action of the dissolved Au compds. Although Cu₂O sol is quite stable toward O₃, PbO sol is easily oxidized. As₂S₃ sol is decomposed with the formation of H₂AsO₄. Sb₂S₃ sol reacts more slowly, yielding H₂SbO₄. S and H₂S are also produced. Bi₂S₃ sol is stable. The action of O₃ on the last 3 sols parallels the stability of the pentavalent compds. of the 3 metals in neutral soln. Ag₂S, HgS and CuS sols are dissolved by O₃ with formation of sulfates. F. L. BROWNE

Turgoelectricity. W. KOPACZEWSKI. *Compt. rend.* **181**, 244-6(1925).—The dispersion of certain colloids and the swelling of gels produced color changes in certain indicators. This was ascribed to redistribution of elec. charges. To test this 2 platinized Pt filament electrodes, connected with an electrometer and amplifying relay, were introduced into a capsule, and the substance to be studied was added, followed by H₂O. Occasional oscillations of the electrometer resulted during the dispersion. Emulsoids produced no effect, fine powders slight, swelling of gels marked, and gelation (Et salicylate—H₂O or Al(OH)₃—AcOH) the greatest effect, about 0.0004 v. Similar momentary effects resulted on adding drops of electrolyte to H₂O. The phenomenon was called "turgoelectricity" and was ascribed to mech. dissociation of H₂O or electrolytes. A. W. FRANCIS

Solubility of urea in water. L. A. PINCK AND MARY A. KELLY. *J. Am. Chem. Soc.* **47**, 2170-2(1925).—Redetn. of the soly. of urea in water over the temp. range 0° to 70° shows the following values at intervals of 10°:

Temp.	0°	10°	20°	30°	39.7°	50°	60°	70°
G. urea in 100 g. H ₂ O	67.0	84.0	104.7	136.0	165.4	205.0	246.0	314.6

These values are higher than the data of Speyers (*Am. J. Sci.* [4], **14**, 293(1902)).

JAMES M. BELL

Solubilities of the phosphates of zirconium and hafnium. G. HEVESY AND K. KIMURA. *J. Am. Chem. Soc.* **47**, 2540-4(1925).—Zr phosphate pptd. from 6 N HCl soln. has the compn. ZrO(H₂PO₄)₂; Hf phosphate is HfO(H₂PO₄)₂. Upon ignition 2 mols. of H₂O are lost in each case. The soly. of Zr phosphate at 20° in 6 N HCl is 0.00012 mol. per l. and of Hf phosphate 0.0009 mol. per l. In 16 N HCl the values are 0.00023 and 0.00012. For good analytical results these pptns. should be made with a great excess of phosphate and in cold soln. JAMES M. BELL

Investigations of the phenomenon of partition. NICOLAS A. KOLOSOVSKII. *Bull. soc. chim.* **37**, 372-81(1925).—Although it was early realized by Berthelot that the coeff. of partition of a substance between two phases is a function of the total concn., the formulas proposed by Nernst and Henry do not take this into account. The distribution of H₂O₂ between H₂O and Et₂O at 18° was studied over a ten-fold concn. range, and it was found that $C = 15.0 - 1.43P + 0.057P^2$, where C is the coeff. of partition, p/p' , and P the total concn. of the H₂O₂. The concn., p , in the aq. phase and the concn., p' , in the Et₂O are related by the equation $p^{1.14} + 0.022P/p' = K$. To express the par-

titution of AcOH between H_2O and Et_2O , the following similar but more complicated equation was used. $p^{1.07 + 0.002P} - 0.008P^2/p' = K$. Data were obtained on the distribution of $FeCl_3$ between H_2O and Et_2O , but they were too erratic to be expressed algebraically. Published data on the distribution of propionic acid between H_2O and Et_2O lead to the equation $p^{1.2} - 0.057P/p' = K$. It is suggested that the form of equation used here, although purely empirical, can be used to express partition data accurately over a wide range of concentrations.

Some physical properties of aniline and its aqueous solutions. M. P. APPLEBEY AND P. G. DAVIES. *J. Chem. Soc.* 127, 1836-40(1925).—Purified $PhNH_2$ showed a blue fluorescence and phys. properties as follows: m. p. -5.98° , d_{20}^{20} 1.02315, n_D^{20} 1.58685, viscosity 0.04468. The decreases of these values by 1% H_2O were 2.6°, 0.00018, 0.0027, and 0.0026. The eutectic was at 2.575% H_2O and -11.85° . Association of both H_2O and $PhNH_2$ in mixts. was indicated.

The vapor pressure of hydrogen chloride in aqueous solutions. I. SHINROKU MITSUKURI, TATSUO ROKKAKU AND TAKEO WATASE. *Sci. Repts. Tohoku Imp. Univ.* 14, 251-8(1925).—Air was passed through 3 saturators contg. HCl at 25° , and the vapors were condensed at 0° in a cond. cell. The partial pressure of HCl of the original solns. was calcd. from the cond. and the difference between the partial pressure of H_2O of the original solns. and the vapor pressure of H_2O at 0° . The concn. of HCl and the logarithm of the partial pressures in mm. were as follows: 0.517, -5.228 ; 0.929, -5.130 ; 1.533, -4.960 . These are much lower than those calcd. by extrapolation of results by Bates and Kirschman (*C. A.* 14, 241) and those from e. m. f. measurements of activity (*C. A.* 12, 15).

Vapor pressures of solutions of phenol and water at 75° . J. B. FERGUSON AND W. S. FUNNELL. *Trans. Roy. Soc. Canada* [iii], 18, III, 122-3(1924).—The vapor pressure of mixts. of phenol and water (7-60% phenol) at 75° is almost independent of the compn. of the mixt.

The surface tensions of aqueous phenol solutions. I. Saturated solutions. A. K. GOARD AND E. K. RIDEAL. *J. Chem. Soc.* 127, 780-7(1925).—Detns. were made by the drop-weight method, Iredale's methods of computation (*C. A.* 17, 2664) being used. 73.06 dynes/cm. is obtained for the surface tension of pure water at 20° . Measurements of the 2 liquid phases at 0° , 17° , 30° and 40° show the surface tensions of the phenol-rich phases to be higher and to approach those of the water-rich phase as the temp. rises. The curves approach as 68.8° (temp. of complete miscibility) is approached, and there is no evidence that they cross at a lower temp. as claimed by Morgan and Evans (*C. A.* 11, 2983). II. Activity and surface tension. *Ibid* 1668-76.—The activity of phenol in water soln. and in $NaCl$ -water solns. was detd. by measuring partition of phenol between the aq. solns. and paraffin oil at 20° , over the concn. ranges 0 to 25% $NaCl$ and 0 to satn. of phenol. The surface tensions of phenol- $NaCl$ -water solns. were also detd. by the drop wt. method. Adsorption of phenol in the soln.-air interface was computed by the Gibbs formula, making use of the activity in place of the concn. The max. adsorption corresponds to a single layer of phenol mols. at the surface, each mol. occupying 23.8×10^{-16} sq. cm. and oriented on edge. The thickness of the adsorbed layer is estd. at 6.4×10^{-8} cm. The presence of $NaCl$ raises the surface tension of phenol solns. in nearly the same degree that it raises that of pure water. This is not in harmony with the Langmuir-Harkins theory, in that the surface layer of closely packed phenol mols. cannot be solely responsible for the surface tension; the "foundation" layers must also be taken into account.

The precipitation laws. P. P. VON VEIMARN. *Chem. Rev.* 2, 217-42(1925).—A review in which the author discusses the numerical data relating to: (1) the laws of pptn., (2) the variables regulating the mean dimensions of the ultramicroscopic particles of disperse phases, (3) the process of dispersion, (4) the dependence on the soly. of a salt of the amt. of adsorption of this salt on a given adsorbent, and (5) the influence on the life of dispersoidal solns. of an increase in the concn. of electrolytes.

A note on the precipitation of bismuth trisulfide from acid medium. S. RAMACHANDRAN. *Chem. News* 131, 135(1925).— Bi_2S_3 is not pptd. from solns. of HCl when the concn. of HCl is greater than 1 part concd. acid to 3 parts H_2O ; nor is pptn. complete in solns. stronger in acid than 1:5. Conversely, pure pptd. Bi_2S_3 is nearly completely sol. in 1:3 HCl at 30° .

Solubility relationships of isomeric organic compounds. IV. The mutual solubility of *o*-, *m*-, and *p*-nitroanilines and of *o*-, *m*-, and *p*-nitrochlorobenzenes. G. T. KOHMAN. *J. Phys. Chem.* 29, 1048-56(1925).—The m. ps. of the nitroanilines were redetd. and found to be: *o* 69.3° ; *m*, 111.8° ; and *p*, 147.5° . The mutual soly. of the 3 nitroanilines was detd. for the 3 binary systems and for the ternary system. The solubil-

gasoline showed the phenomenon. FeCl_3 and $(\text{COOH})_2$ solns. were unaffected.

A. W. FRANCIS

Phase boundary forces at the interface gas liquids. III. Electrical properties of monomolecular layers of insoluble substances. A. FRUMKIN. *Z. physik. Chem.* 116, 485-97(1925); cf. *C. A.* 18, 1934; 19, 1799.—A method based on radioactive principles is described and a drawing of the app. given, for the measurement of p. d. at the surface air | monomol. layer of an insol. substance spread on the surface of acidified water. Measurements are given for heptyl, capryl, capric, lauric, myristic, palmitic, stearic, cerotinic, oleic, elaidic and α -bromostearic acids; ethyl oleate, triolein, tripalmitin; cetyl and myristyl alcohols; stearamide and heptadecylamine on the surface of 0.01 *N* HCl. A measurement is made of heptadecylamine on the surface of 0.0001 *N* HCl and 0.01 *N* NaOH. When the substances were solid at ordinary temps. a petroleum ether soln. was used to obtain the desired layer. The observed effects of the higher members of homologous series can be explained on the basis of the orientation proposed by Langmuir, but the effect per mol. is less than in the lower members. When applied to sol. substances this method yields results which are in agreement with those obtained by Kenrick's method.

R. SCHIERZ

The influence of hydrogen and substituted halogens on the properties of organic compounds, especially on their boiling points. A. F. VAN ARKEL AND J. H. DE BOER. *Rec. trav. chim.* 44, 675-92(1925).—Data are reviewed showing that in various compds. H shows a variable character ranging all the way from electropositive H to electronegative H, with every kind of intermediate stage. v. A. and de B. have tried to find a phys. property by which this variable nature of H may be expressed numerically. In this paper the b. p. data are examd. in this way. Conclusion: In every group of org. compds. the $\sqrt{\alpha}$ -value per halogen atom is for each halogen proportional to the vol. The values of $\sqrt{\alpha}$ are different in different groups and are smaller the more atoms there are present close to the halogen atom. Although in the methane, ethane and propane series the central atom is so much enveloped by the halogen and H atoms that it cannot act toward the outside, this is not the case with the ethylene-, benzene- and Si-compds. The envelopment of the central atoms becomes more effective the larger the vol. of the surrounding atoms becomes. In this way it becomes comprehensible that C_2H_4 and Cl-ethylene compds., as well as SiF_4 (to give complexes: H_2SiF_6 , etc.), have good addn. powers, while C_2I_4 is preferably formed from satd. Cl_4 by splitting off I, and why SiBr_4 , for instance, shows no inclination to form complexes. F with its at. vol. of 11 shows its relationship with the other halogens. H on the other hand shows an inconstant $\sqrt{\alpha}$ -value. This value is smallest in the hydrocarbons and becomes larger the more halogen is bound with the H to the same C atom. Even the substitution of halogen in other hydrocarbon groups exercises a small influence on the $\sqrt{\alpha}$ -value of H. Multiple bonds also influence the $\sqrt{\alpha}$ -value for H atoms.

E. J. WITZEMANN

Angles of contact and polarity of solid surfaces. N. K. ADAM AND GILBERT JESSOP. *J. Chem. Soc.* 127, 1863-8(1925).—The work of adhesion of a solid-liquid surface was estd. from the equation $W = T_{LV}(1 + \cos \theta)$, where T_{LV} is the surface tension of the liquid and θ is the angle of contact. The angle was detd. by adjusting a glass plate covered with the substance being studied at such an angle in the surface of H_2O that the latter was level right up to the plate, as observed by reflection. The angle was about 100° for paraffin either solidified in air, solidified in H_2O , or scraped; for octadecyl iodide solidified in air or scraped; and for hexadecyl alc. and palmitic, stearic, and eicosanic acids if solidified in air. The latter compds. showed much lower angles if scraped and slightly lower angles if flakes of crystals from a solvent were used, because of the exposure of polar groups.

A. W. FRANCIS

The practice and colloid-chemical evaluation of the oil drop-water experiment. O. OHMANN. *Z. physik. chem. Unterrichts* 38, 36-7(1925).—O. recommends a mixt. of 2% phenol in olive oil which he finds to be very satisfactory for the demonstration of the spreading of a drop of oil on a water surface.

M. BEBER

The distribution of surface active materials between water and organic solvents. R. G. SCHULZ. *Kolloidchem. Beihefte* 21, 37-54(1925).—At the interface between 2 liquids the same relations hold true between surface activity and partition of a solute between the liquids as are found for the liquid-solid interface, i. e., for the adsorption of a solute from soln. by a solid adsorbent. The distribution of a solute between H_2O and an immiscible org. liquid depends upon the relation between (A) a force of attraction between solute and H_2O and (B) a force of attraction between solute and org. liquid. (1) If A is large and B small there will be no partition—examples, EtOH and HOAc. (2) If A is small and B large the solute will be completely removed from the H_2O —

examples, octyl alc. and caprylic acid. (3) If A and B are not too dissimilar in magnitude there will be a partition of the solute between H_2O and the org. liquid which will favor accumulation in the org. liquid in proportion as the solute is more surface active—examples, butyl alc. and butyric acid. In case (3) the solute can be completely extracted by the org. liquid if a large enough amt. is employed unless A is especially high.

F. L. BROWNE

Kinetic theory of surface films. I. Surfaces of solutions. R. K. SCHOFIELD AND E. K. RIDEAL. *Proc. Roy. Soc. (London)* **109A**, 57-77 (1925).—A correct application of Gibb's equation to the surface tension-concn. curves for aq. solns. of a no. of capillary active org. substances supports the idea of the unimol. character of the adsorbed film. The views of Traube relating surface tension to osmotic pressure is examd. and a modification, $F(A-B) = xRT$, analogous to that of Amagat's eqn. for highly compressed gases, is suggested. In this eqn., F is the surface tension, A the area occupied by 1 g. mol. of the active substance at the interface, B the limiting area of a g. mol. under high compression and $1/x$ is a measure of the lateral mol. cohesion. This equation fits existing data for H_2O -air, H_2O - C_6H_6 , and H_2O -Hg interfaces and gives values for $1/x$ in agreement with those anticipated. The value of B for H_2O -air and H_2O - C_6H_6 interfaces is common for normal fatty acids, thus supporting Langmuir's orientation hypothesis. The lateral mol. cohesion increases with the length of the hydrocarbon chain. Sucrose mols. do not cohere at a H_2O -Hg interface. The view that the effect of capillary active substances on surface tension is due to thermal agitation alone, is supported.

ARTHUR GROLLMAN

The action of colloidal and semicolloidal iron oxide on aqueous solutions of gelatin. R. WINTGEN AND E. MEYER. *Kolloid-Z., Special No.*, April 1, 1925, 369-79.—Fe oxide hydrosols were prepd. as follows: (1) A soln. of NH_3 was slowly added in small portions with stirring to a soln. of 50 g. of hydrated $FeCl_3$ until the Fe hydroxide formed was not dissolved after several hrs. Any ppt. was filtered out. The hydrosol was dialyzed by the method of Neidle (cf. *C. A.* **10**, 1957) for 50 hrs. at $70-80^\circ$. (2) The method of the German Pharm. similar to (1) was used but the sol was dialyzed 30 hrs. (3) Prepd. same as (2) but dialyzed 7 days by the method of Zsigmondy and Heyer (cf. *C. A.* **5**, 821). (4) The com. product from Gehe & Co. contained 3.796% Fe content. (5) Prepd. as (1) but dialyzed in the cold. The sols (1), (2), (3) and (5) were dild. to 1.5% Fe content. By analysis sols (1) to (5) contained for 1 g. atom of Fe, resp., 0.1382, 0.1981, 0.2365, 1.148, 1.461 g. atoms of Cl. Weighed quantities of electrolyte-free gelatin were allowed to swell in cold H_2O for 5 hrs., then dissolved in H_2O at $60-70^\circ$, dild. to a 5% soln. and protected from decompn. by a little thymol. The pptns. at 25° were arranged so that in a series of test glasses contg. in each a final vol. of 18 cc.: (1) (a) increasing amts. of the gel sol dild. with H_2O were added to a const. amt. of Fe oxide sol or (b) a const. amt. of the Fe oxide sol was added to increasing amts. of gel sol dild. with H_2O ; (II) (a) increasing amts. of gel sol were added to a const. amt. of Fe oxide sol dild. with H_2O or (b) a const. amt. of Fe oxide sol dild. with H_2O was added to increasing amts. of gel sol. For (I) the quantity of ppt. increased with increasing amts. of gelatin to a const. value. For (II) with increasing amts. of gelatin, the quantity of ppt. rose to a max., then decreased to 0 and finally increased again (cf. Zsigmondy and Joel, *C. A.* **19**, 764). The min. for the different sols used in (II) occurred at 6.2 cc. of sol (1); 6.5 cc. of sol (2); 6.6 cc. of sol (3); 4.2 cc. of sol (4); 3.8 cc. of sol (5). With the typical colloids, sols (4) and (5), the quantity of gelatin necessary to start pptn. of the Fe oxide sol decreased in a linear relation with the dildn. of the Fe oxide sol; but with the semicolloids, sols (1) and (2), the quantity of gelatin increased at first and produced curves (not linear). The relation between the quantity of gelatin necessary to start pptn. and the concn. of the Fe oxide sol was reversed—linear with the sols (4) and (5), and curved with sols (1) and (2).

H. M. McLAUGHLIN

Protective action of soaps and further evidence in favor of the chemical theory of adsorption. III. S. S. BHATNAGAR, MATA PRASAD AND D. C. BAIJ. *Quart. J. Indian Chem. Soc.* **2**, 11-22 (1925).—The protection of colloidal solns. by soap soln. was studied with As hydrosulfide, Sb hydrosulfide, Cd hydrosulfide, in colloidal soln. and ZnO , MnO_2 , Al_2O_3 , Pb_2O_4 , fuller's earth, $BaCO_3$ and $PbCl_2$ as solid adsorbents. The investigation was made by the use of Douman's drop pipet and the no. of drops in a given vol. of soap soln. was counted under standard conditions. The drop nos. increase with increase in soap concn. and the surface tension decreases as the soap concn. increases. The drop nos. of the colloidal solns. were detd. likewise; and it was shown that the colloids do not take any part in altering the surface tension of the dispersing medium. The colloidal solns. were mixed with the soap solns. of different concns. and allowed to stand 24 hrs. The no. of drops in the same vol. of the mixed solns. was counted and

the concns. of the soap after adsorption were detd. The quantity of soap adsorbed per 100 cc. of soln. was then calcd. The observed concn. of the soap is not as is expected on mixt. law but is in all cases less. The diminution in concn. is due to the absorption of soap mols. by the particles of colloidal solns. The same conclusion can be drawn from the expts. made on fine powders. The adsorbed soap loses its well-known property of dissolving in water and lowering the surface tension and thus supports the chemical theory of adsorption. 14 tables are given. E. SCHERUBEL

The adsorption of gases by graphitic carbon. H. I. LOWRY AND S. O. MORGAN. *J. Phys. Chem.* **29**, 1105-15 (1925), cf. *C. A.* **18**, 2094.—Graphites of different adsorptive capacities were prepd. as follows: Ceylon graphite, previously treated with HF to reduce the ash content, was digested with fuming HNO_3 , washed and heated to increase its vol. It was then oxidized to "graphitic acid" by treatment with fuming HNO_3 and KClO_3 , the degree of oxidation being controlled by varying the number of treatments. The "graphitic acids" were then converted to graphite by exposing them *in vacuo*. Adsorption data for CO_2 at 0, 35, 56.7, 80.4, 100°, for N_2 at 0, 56.7, 100°; and for H_2 at -191° and at pressures up to 1 atm. are given. While graphite from the "graphitic acid" which was least oxidized absorbed the least gas, there was no quantitative proportionality between the degree of oxidation and the amt. of gas adsorbed. The graphite showing the highest adsorptive capacity adsorbed $\frac{1}{2}$ to $\frac{1}{3}$ the amt. of N_2 at 100° and 760 mm. pressure that the best adsorptive charcoal will adsorb. The data are in general agreement with the hypothesis that any treatment which will increase the ratio of surface to mass or the degree of unsatn. of the at. forces of a solid adsorbent, or both, will increase its adsorptive capacity. F. L. BROWNE

The adsorption of hydrogen iodide gas by glass surfaces. E. MOLES AND R. MIRAVALLS. *Anales soc. españ. fis. quim.* **23**, 223-30 (1925).—The wt. of HI gas adsorbed by the walls of glass bulbs, which had been used for the detg. of the d. of HI gas, was detd. by 2 methods: (1) bulbs whose walls were satd. with HI gas as a result of prolonged usage were thoroughly washed with H_2O and the I^- was pptd. therefrom with AgNO_3 ; (2) the same bulbs were cleaned with $\text{H}_2\text{SO}_4 + \text{K}_2\text{Cr}_2\text{O}_7$, washed, dried, evacuated to 0.005 mm. and weighed. They then stood 72-96 hrs. filled with HI gas at 760 + mm., were evacuated to 0.4-0.6 mm. and weighed. The increase in wt. was less than that calcd. from the pressure of the HI gas in the bulb because of the displacement of adsorbed H_2O by the HI. The bulbs were filled again with HI and evacuated as before, after which the observed increase in wt. was greater than that calcd. from the pressure of the contained gas, because of the adsorption of HI. The wt. of HI absorbed, calcd. per l., was: Bulb N-4, vol. 730 cc., (1) 1.97×10^{-3} g., (2) 1.99 and 1.83×10^{-3} g.; bulb N-2, vol. 608 cc., (1) 2.12×10^{-3} g., (2) 1.98 and 2.21×10^{-3} g. It is calcd. that this amt. of HI might form a layer on the glass 30-35 mol. thick. This anomalous result is attributed to there being capillary condensation, and chem. reaction between the gas and the glass, in addn. to the true adsorption. R. H. LOMBARD

The adsorption properties and particle size of several lampblacks in organic liquids and in crude rubber mixtures as well as the effect of these lampblacks on the properties of vulcanized products. M. LEBLANC, M. KRÖGER AND G. KLOZ. *Kolloidchem. Beihefte* **20**, 356-411 (1925).—Using a no. of com. lampblacks of German and American origin, the authors sought to detect any possible relation between the properties of a lampblack and its behavior in its mixt. with rubber. The work coned. on a study of (1) the general characteristics of the lampblack as such, (2) of mixts. of lampblack with crude rubber, (3) of rubber-lampblack-benzene sols vulcanized in the cold, and (4) of hot vulcanized rubber contg. varying amts. of lampblack admixed. **Conclusions.**—It is impossible to predict the properties of rubber-lampblack mixts. from a study of the crude lampblack. The sedimentation phenomena observed for lampblack dispersed in org. liquids are dependent upon various factors. Thus, the time of sedimentation for different makes of lampblack varies with the liquid used and also with the time of exposure to one and the same liquid. Lampblack suspended in an org. medium does not show any adsorptive capacity for S, I or mercaptans. The sorptive capacity for water vapor, as well as the sp. vol. detd. by shaking with a liquid, shows irregularities which may be traced back to the ash content and the content of extractives. The different lampblacks have different effects upon crude and vulcanized rubber. The tensile strength and resistance to wear of vulcanized rubber increase with the addn. of lampblack. A certain relation exists between the effect of the individual lampblacks and their particle size and adsorptive characteristics, which can be judged from the tendency for crude rubber-lampblack mixts. to become dispersed in benzene and by detn. of the viscosity of the benzene sols. Dispersion takes place very readily with an inferior lampblack, more difficultly with a good grade. High viscosity of the sol corresponds to a good lamp-

black, and *vice versa*. A parallelism exists between these viscosity detns. and the effect of the various lampblacks upon the resistance to wear of vulcanized material, while the parallelism is not quite complete for the tension series. The degree of dispersion of lampblack in the crude rubber-lampblack-benzene sols varies considerably for the different lampblacks. A high degree of dispersion is necessary, but not sufficient, for the development of great adsorptive power. Marked differences are observed in the rate at which gels of equal elasticity are formed by vulcanization of the gel in the cold. These differences may be traced back to variations in the degree of aggregation of the rubber particles as is shown by the effect of the lampblacks in the milling. The disaggregating effect increases with decreasing size of the lampblack particles.

PER K. FRÖLICH

The influence of the salt content on the adsorptive power of active charcoal, as well as a review of the principal characteristics of the most important technically prepared active charcoals. HEINRICH HERBST. *Kolloidchem. Beihefte* 21, 1-36(1925).—The service time of active charcoal, impregnated with varying amts. of KOH, K_2CO_3 , or their solns. in H_2O was detd. against CCl_3NO_2 , Cl_2 , $COCl_2$ and HCN. For charcoal and KOH the service time toward CCl_3NO_2 decreases as the amt. of KOH increases, becoming 0 at 50% KOH. Toward $COCl_2$ the service time increases markedly up to 25% KOH and then falls off again. Toward Cl_2 and HCN the service time increases rapidly with KOH content up to 12% and then remains nearly const. When H_2O is present in addn. to KOH, the increase in service time toward $COCl_2$, Cl_2 and HCN is much more marked and there is no falling off after reaching a max. Charcoal impregnated with H_2O or K_2CO_3 solns. shows a decrease in service time proportional to the total wt. of H_2O plus K_2CO_3 added. The presence of H_2O in the charcoal decreases the service time toward HCN slightly, but impregnation with K_2CO_3 soln. gives a marked increase. Toward $COCl_2$, H_2O up to 30% and K_2CO_3 solns. up to 50% increase the service time markedly, but further amts. cause it to fall off exceedingly rapidly. Toward Cl_2 , H_2O and K_2CO_3 increase the service time in proportion to the amt. added. It is concluded that charcoal is most effective in purely adsorptive processes when free from H_2O or impregnating compds. and that the activity is decreased in proportion to the amt. of H_2O or compds. present. Where "secondary catalytic reactions" are involved, impregnation with dry salts up to 15-20% increases the effectiveness, after which further impregnation causes it to fall off again, but impregnating with H_2O or salt solns. up to 50-60% increases the effectiveness. The adsorptive characteristics both for gases and for aq. solns. of a number of commercial charcoals are described. The total amt. of substance that a charcoal will absorb, or its activity, depends upon the purity of the C and the ultraporosity and in general is directly proportional to the apparent d. The velocity of adsorption is roughly inversely proportional to the cube of the apparent d.

F. L. BROWNE

Adsorption. XI. Influence of ions carrying the same charge as the sol on the coagulation of sols of (1) Prussian blue and of (2) positive ferric hydroxide. S. GHOSH AND N. R. DHAR. *J. Phys. Chem.* 29, 659-78(1925); cf. *C. A.* 19, 3046.—Continuation of the investigations on Prussian blue and hydrous Fe_2O_3 sols indicate that abnormal behavior on diln., abnormality toward mixt. of electrolytes and the phenomenon of acclimatization are essentially connected and go hand in hand. Smaller quantities of KCl and KNO_3 are required when Prussian blue is coagulated in the presence of HCl or HNO_3 . This is due to the cutting down of the hydrolysis of Prussian blue and the consequent formation of the stabilizing ferrocyanide ion. The influence of several non-electrolytes on the coagulation of As_2S_3 and Sb_2S_3 was investigated but no explanation of the results was offered.

HARRY B. WEISER

Soaps and the theory of colloids. J. W. MCBAIN. *Proc. Roy. Inst. Gr. Britain* March 20, 1925, 6 pp.; cf. *C. A.* 19, 741.—A brief review of the bearing of the studies of soap sols. carried out by McB. and his co-workers on the general theory of colloids.

F. L. BROWNE

The protective effect of soap on gold hydrosol prepared by the method of Zsigmondy. B. PAPACONSTANTINOU. *Kolloid-Z.*, Special No., Apr. 1, 1925, p. 329-33.—The relationship between the emulsifying power of soap and its value in washing is close. By Zsigmondy's method Au sols with reproducible properties may be made. Soap solns. whose concn. was 0.1-0.2% were used. As the size of the colloidal Au particles increased the protective effect of the soaps decreased. When the temp. was raised the protective action increased. The alky. has a great effect on the protective action of soaps. Increasing alky. reduces protective action. Increasing concn. of electrolyte produces decreasing protective action. Soaps of lauric, of myristic and of palmitic acids have equal effects whether Na or K replaces H. K-soaps of stearic and of linoleic acid are

more effective than Na-soaps, at higher temps. Na oleate is more effective than K oleate. At room temp. the Au no. increases in order as the soap is made from the acids, oleic, palmitic, stearic, myristic and lauric. If it could be shown that these adsorbability series were independent of the chem. nature of the colloid particle, such expts. could predict the effectiveness of soap in washing.

F. E. BROWN

The surface concentration of sodium oleate and of colloidal sulfur. J. M. JOHLIN. *J. Phys. Chem.* **29**, 1129-39 (1925); cf. *C. A.* **19**, 1516, 3047.—The surface tension of sodium oleate solns. of 1.0 to 0.0001% concn. was measured. In the case of the stronger solns. the change with time was exceedingly rapid but took place according to the equation previously given. Alkali added to 0.1% solns. was found to cause a decreasing irregularity as the amt. of alkali was increased until the change with time fluctuated periodically up and down. Alkali was found to cause a decreased tendency to foam. The change of surface tension with time in a regular manner according to the given equation only takes place in the case of colloidal solns. in which the solute is highly dispersed in a manner similar to that of true solns. The surface tension of colloidal S solns. will under certain conditions change with time according to the given equation. No other inorg. colloid was found to behave similarly. This behavior cannot be reconciled with the assumption stated above and it cannot be said to what extent the phenomenon is due to the presence of pentathionic acid.

F. L. BROWNE

General method for the exact investigation of diffusion phenomena in gels. R. FRICKE. *Z. Elektrochem.* **31**, 430-45 (1925).—The gel, contained in a glass tube, is kept in contact at one end with a large vol. of soln., maintained at const. temp. and concn. by continuous stirring. A *microlome* is described by which the gel is cut into fine slices which are analyzed microchemically. Results are given for the diffusion of NaCl in agar.

ARTHUR GROLLMAN

The silicic acid sol. H. R. KRUYT AND J. POSTMA. *Rec. trav. chim.* **44**, 765-89 (1925) (in English).—The silicic acid sols were prepd. by pouring a soln. of silicate into HCl and then dialyzing. All sols obtained in this way appeared, from cataphoresis detns., to move towards the anode, *i. e.*, to be negatively charged. The law of Poiseuille holds for the silica sol at 20°. The sols are more stable at room temp. than at higher temps. The shorter the time of dialysis of a sol, the greater is its increase in viscosity with the time. From this it is concluded that as a rule the time of flow of a sol increases from the time of its formation. An exception to this rule is made by a small group of sols. There are 2 groups of silicic acid sols. The 1st group, which is the most common, has an increasing relative viscosity with the time and a p_H of ± 4.5 . Sols of the 2nd group seldom occur directly by dialysis; they have a relative viscosity which decreases directly with the time and a p_H of about 6 or higher. The reason for the occurrence of these sols must be looked for in the occlusion of silicate. By adding HCl to a sol of the 2nd type it may be changed into one of the 1st type if enough is added to reduce the p_H to 4.5 or less. Conversely the addn. of enough NaOH soln. to a sol of the 1st type changes it into a sol of the 2nd type. Na silicate solns. can also bring about this change. In general Na silicate has the same effect on a sol as NaOH of the same normality. If HCl is poured into a sol with increasing viscosity, this increase remains in existence. The negative charge is first removed. If still more HCl is added the sol becomes positively charged. Salt solns. discharge the sols and cause a rapid increase in viscosity and finally gelation or flocculation. The discharge of the sols by HCl and by salt solns. is evident from the disappearance of von Smoluchowski's electroviscous effect, by which the initial relative viscosity is lowered on the addn. of electrolytes. Conversely an increase of this initial viscosity took place on addn. of NaOH or Na silicate on account of a greater electroviscous effect due to a higher negative charge. The final viscosity was considerably lowered by the addn. of 50% H_2O to the sols. On account of the diln. changes in the viscosity of 50% aq. sols on standing are extremely small. The addn. of EtOH probably has a slight dehydrating action on the sols, judging from the detns. of viscosity. Silicic sols take up OH ions and Cl ions. The disappearance of a great no. of OH ions on the addn. of NaOH or Na silicate can be established by p_H detns. On warming the sols with Cl-free HNO_3 Cl is set free which could not be detected before this treatment. This shows that the sol particles had first fixed Cl. Apparently silicic acid particles have the power of filling themselves like a sponge, with OH and Cl ions.

E. J. WITZEMANN

Effect of colloids in the displacement of lead and copper from their salts by zinc. L. T. M. GRAY. *J. Chem. Soc.* **127**, 776-80 (1925).—The crystals of Pb which deposit on thin Zn foil dipped in $Pb(AcO)_2$ soln. contg. gelatin changed steadily from very small needles to small nodules of increasing size as the gelatin content increased from 0 to 0.3 to 0.4%. When this proportion of gelatin was reached, the size of the nodules diminished and the

nodular structure was replaced by a branched structure, the deposit closely resembling the original small needles. A max. for grittiness and size of particles was also found with glue, but not with gum arabic. Similar results were obtained for Cu. The colloids cause a decrease in crystal size and in cohesive power. With Pb the size of the component crystals diminishes fairly steadily throughout; but the cohesive power, by which they form larger aggregates, increases to a certain point and then decreases. With Cu the decrease in crystal size is the detg. factor. The poor deposit with higher concns. of colloid results from the higher proportion of adsorbed colloid. HARRY B. WEISER

Spontaneous structure formation in sols; a new kind of anisotropic liquid media. H. ZOCHER. *Z. anorg. allgem. Chem.* 147, 91-110(1925).—Upon cooling hot, concd. sols. of benzopurpurin 4B and chrysophenin sols long colloid particles arranged in parallel order were observed. In old V_2O_5 and $Fe(OH)_3$ sols of suitable concn. anisotropic colloid particles with parallel orientation gather in high concn. The Brownian movement is still present in such sols as a brisk oscillation about an equil. position. Vigorous agitation causes the structure to vanish completely. In the course of time it forms again provided that coagulation, in its narrow sense, does not set in. In V_2O_5 sols the rod-shaped particles stand with reference to each other with two sides parallel, clinging together at the edges and stretching out in fan-shapes from the ends. In $Fe(OH)_3$ sol the disc-shaped particles lie with their rims close together in large sheets. These sheets are equidistant from one another, resulting in recurring lamellae with spacing equal to a wave length of light and producing a strong play of colors. In the magnetic field these strata systems become anisotropic in the direction of the strata and reflect polarized light. The elec. field alters the spacing of the strata. Mech. motion acts like the magnetic field. Temp. changes have no important influence.

* **Titania jellies.** SIMON KLOSKY AND CHRISTOPHER MARZANO. *J. Phys. Chem.* 29, 1125-8(1925).— Na_2TiO_3 was dissolved in 35% HCl and the acid neutralized by the dropwise addn. of K_2CO_3 , Na_2CO_3 or $(NH_4)_2CO_3$. Vibrant jellies were obtained similar to SiO_2 jellies. By adding $FeCl_3$ to the acid titanate soln. jellies of TiO_2 and Fe_2O_3 result. F. L. BROWNE

Contribution to general colloid chemistry. XIV. The constitution and stability of ferric oxide sols. IV. N. KÜHNL AND WOLFGANG PAULI. *Kolloidchem. Beihefte* 32, 319-37(1925).—A study of the arrangements of the mols. and complexes in the particles of Fe_2O_3 sols prepd. by peptization. These sols and similar sols prepd. by hydrolysis exhibit marked differences in ionogenic character, a phenomenon which is made the subject of extensive discussions. **XV. The structure of hetero-peptides 1. (Al-Fe)-oxide sols.** *Ibid* 338-55.—Mixed sols consisting of Al-oxide and Fe-oxide are prepd. by peptization. The mechanism of the peptizing process and the ionogenic characteristics of the resulting complexes are studied. A discussion of the possible distribution of the 2 components is included and it is suggested that the individual particles of the heterogeneous sol may be regarded as mixed crystals. PER K. FRÖLICH

General colloid chemistry. XVI. The constitution of silicic acid sols. 1. W. PAULI AND E. VALKO. *Kolloid-Z.*, Special No., Apr. 1, 1925, 334-40; cf. preceding abstract.—The electrochem. properties of silicic acid have been studied to obtain an insight into the constitution of the sols and to establish the dependence of these properties upon the stability of silicic acid sols. Sols were prepd.: (1) from Na_2SiO_3 according to Graham, (2) by sapon. of the Me ester of silicic acid and (3) by decompn. of $SiCl_4$. With continued dialysis of silicic acid sols prepd. by (1) a const. value for cond. was attained which showed that the sols themselves possessed a relatively considerable cond. The constitution of the sol particles could be expressed by $x(SiO_2 + nH_2O).ySiO_3H^- + yH^+$ or (yNa^+) . The values for the ratio $x:y$ which represents the no. of neutral SiO_2 mols. per unit charge were between 320 and 1200. The cations H and Na^+ contained in the sols after simple dialysis were interchangeable. With the help of electrodialysis (cf. C. A. 19, 1431) stable, pure sols were produced. Electrodialysis was also used to prep. highly concd. sols out of dil. sols. H. M. McLAUGHLIN

The peptization of bismuth hydroxide. A. KUHN* AND H. PIRSCH. *Kolloid-Z.* Special No., Apr. 1, 1925, 310-8.—When $Bi(OH)_3$ is pptd. by adding drop by drop with const. stirring 50 cc. of concd. NH_4OH to 100 cc. of acidified 0.1 N $Bi(NO_3)_3$, $Bi(OH)_3$ uncontaminated with basic salts is pptd. When this ppt. is centrifuged and washed by decantation 3 or 4 times, it becomes colloidal. The ppt. may be peptized also by dialysis. When the cond. falls to 2×10^{-4} peptization begins. The concn. of Bi present as a sol increases as the cond. decreases. A sol contained 2.14 g. of Bi per l. when first made, 1.9 g. after 3 days and 0 g. after 7 days. The addn. of raw sugar, mannitol, lactose or glycerol did not increase the stability of the sol. $Bi(OH)_3$ sols

are better peptized when the NH_4OH is added suddenly than when it is added gradually, and a concn. of 0.1 is better than 0.01 for the $\text{Bi}(\text{NO}_3)_3$. It is more difficult to peptize the ppt. after it has stood in contact with its supernatant liquid. When the ppt. was washed 3 times after centrifuging it peptized more readily than when washed more or less. Raw sugar and mannose peptize best at a concn. of 0.05. Lactose and glycerol have no max. The amt. of Bi in suspension per l. increased with increasing concn. as far as the expts. were carried: 46% for glycerol, and 0.01 M for lactose. At a concn. of 0.01 M , lactose was keeping 2 g. of Bi per l. in colloidal form. The action of sucrose and mannose seemed to be merely peptization, while that of lactose and sugar was based on a chem. process.

F. E. BROWN

The theory of Liesegang rings. Wo. OSTWALD. *Kolloid-Z.*, Special No., Apr. 1, 1925, 380-90; cf. Popp, *C. A.* 19, 2432.—The proposed "Diffusion Wave Theory" of Liesegang rings refers only to rhythmic pptns. resulting from chem. reactions in which the components diffuse towards one another. It is based on the following ideas: (a) in all reactions systems which produce typical rhythmic pptns., at least 3 principal diffusion waves are formed and interfere; (b) many, perhaps, all typically rhythmic, pptn. reactions belong in the sense of the mass action law to the so-called "limited" reactions, *e. g.*, in contrast with such reactions as the pptn. of BaSO_4 , they are incomplete. The diffusion of NH_4OH into a gel contg. MgCl_2 is discussed in detail and considered typical of a series of reactions, including $\text{AgNO}_3 + \text{K}_2\text{Cr}_2\text{O}_7$, $\text{Pb}(\text{NO}_3)_2 + \text{KI}$, etc. At first the diffusion wave of the NH_4OH into the gel is retarded by the formation of $\text{Mg}(\text{OH})_2$, which keeps the concn. and the diffusion gradient of the NH_4OH in the gel small. The MgCl_2 sets up a diffusion wave towards the NH_4OH , *i. e.*, region of lowest concn. At the same time the diffusion gradient of the reaction electrolyte increases rapidly ($2\text{NH}_4\text{Cl}$ is formed per MgCl_2). The NH_4Cl diffuses (wave spreads) in opposite directions from a max. concn. where the concn. of the NH_4OH and the MgCl_2 is kept so small that the pptn. of $\text{Mg}(\text{OH})_2$ is prevented in accord with the mass action law. The following exptl. observations are mentioned in support of the theory: (1) all rhythmic ppts. dissolve in an excess of the reaction electrolyte, *e. g.*, the rings of $\text{Mg}(\text{OH})_2$ are dissolved successively by the diffusion of an excess of NH_4Cl into the gel. (2) Previous addn. of the reaction electrolyte to the gel changed the width of and the distance between the rings. Continuous ppts. were decomposed into rings (*e. g.*, adding 0.1-0.15 N $(\text{NH}_4)_2\text{SO}_4$ to 0.05 N CoSO_4 in a 3% gel before allowing 2 N NH_4OH to diffuse into the gel) and inversely rings disappeared by the extension of the initial ppts. (*e. g.*, adding NH_4Cl to a gel contg. MnCl_2 before the NH_4OH enters by diffusion). (3) When one component was varied in the sense of the mass law, the pptn. became continuous (*e. g.*, diffusing NaOH or KOH instead of NH_4OH into a gel contg. MgCl_2). (4) Metastable limits, peptization and coagulation, adsorption on ppts., etc., are not considered fundamental conditions for rhythmic pptn. These and other phenomena are secondary factors insofar as they influence the form, position and velocity of the diffusion wave as well as the conditions for pptn. in the sense of the mass action law.

H. M. MCLUGHLIN

Dispersion and the interchange (ionic) of bases. G. WIEGNER. *Kolloid-Z.*, Special No., April 1, 1925, 341-69; cf. *C. A.* 6, 2477, 3304.—Expts. have been undertaken to show the importance of the interchange of bases for coagulation, hydration and imbibition of clay ultramicros and to det. to what extent this ionic interchange enters into the dispersion equil. of clays and the general importance of this for dispersoid chemistry. When the ultramicros of the clay are dissociated into ions the highly complex anion of the silicic acid is held by the unsatd. forces of the Al atom on the surface of the clay from the dehydrated complexes already in the ultramicron (cf. Fajans and Beckerath, *C. A.* 15, 2223). On the surface of the clay ultramicron the anions (OH^- or silicic acid) are held more firmly by the unsatd. lattice forces of the Al atom than the cations—especially easily hydrated ions, such as K^+ , Na^+ and Ca^{2+} —are held by the weak residual forces of the silicic acid mols. Each particle is considered similar to a spherical condenser with an outer, dynamic, ionic covering more or less loosely held by forces dependent on the nature of the surface. This outer shell, from electrostatic considerations, would be opposite to an inner layer of oppositely charged ions. The potential of the particle would vary in accord with the laws of spherical condensers. The crit. potential below which coagulation would occur varies with the nature and valence of the cations which evidently det. the hydration and d. of the ions in the outer layer. The potential of the particle and its stability differ with the hydration of the outer ions, *e. g.*, a Li clay contg. the strongly hydrated Li ion in the outer layer must have a higher potential and a greater stability than a Cs clay contg. the less hydrated Cs^+ in the more dense outer layer. The following series of clays is arranged in the order of

their increasing stability: (a) univalent cations: H, Cs, Rb, K, Na, Li; (b) bivalent cations: Ba, Sr, Ca, Mg. The addn. of electrolytes to the dispersion medium causes a new arrangement of the ions, first in the outer layer. The little hydrated Cs^+ added to a Li clay strongly enters into the outer layer and rapidly decreases the potential below its crit. point for coagulation. The highly hydrated Li ion added to a Cs clay does not enter into the outer layer so easily and a relatively large quantity of Li ion is required before the crit. potential is reached. This ionic interchange always increases or decreases the coagulation according to the position of the ions in the hydration series. On the other hand the stability of the colloidal systems is limited primarily by the nature of the ions in the outer layer. Ultramicros contg. highly hydrated ions were, in pure H_2O , voluminous, slimy and viscous. Those contg. less hydrated ions around the primary particles were less viscous and more granular. Calens. of the potential of clay particles from data by Mattson (cf. *C. A.* 16, 2003) indicated that the particles may be dispersed into primary of about 7μ diam. and secondary particles. The latter are formed by agglomeration which is limited by the electrolyte content of the entire system. The surface of the primary particles participates in cation exchange in accord with the same laws as that of the secondary. The exchange of bases det. the potential of the secondary particles and by it the stability of the entire system. Pure Na, NH_4 , K and Ca clays treated with solns. of KCl or CaCl_2 were the more stable, the greater was the hydration of the cations in the outer shell. Viscosity was, in general, higher for coagulations of clays contg. highly hydrated stabilizers. When slightly hydrated ions were used for coagulating clays with strongly hydrated inner ions (e. g., CsCl for a Na clay) an especially voluminous aggregate formed which showed high viscosity. The use of highly hydrated ions to coagulate clays contg. little hydrated inner ions (e. g., LiCl for a K clay) formed less voluminous ultramicros with low viscosity. Schulze's valence rule did not hold. The time required for the coagulation of a dispersion contg. 32 g. of Ca clay per l. with 0.001 *N* solns. of KCl and of CaCl_2 was, resp., 11 and 10 min.; but when 8 g. of Ca clay per l. were present the time required was, resp., 95 and 32 min. For the following wts. of K clay per l. coagulated with 0.005 *N* solns. of CaCl_2 and of KCl the time required was, resp.: 42.2 g., 4 and 13 min.; 21.1 g., 2 and 16 min.; 10.5 g., 5 and 20 min., 5.28 g., 9 and 32 min.; 1.3 g., 35 and 98 min. Similar relations have been found with other sols, such as S and V_2O_5 (cf. Gessner, *C. A.* 19, 4).

H. M. McLAUGHLIN

The use of tap water as the outer liquid in dialysis. ERNST WILKE-DÖRFURT AND MARTA DEKER. *Kolloid-Z., Spec. No.*, Apr. 1, 1925, 305-10; cf. *C. A.* 17, 1737.—Colloidal SiO_2 was prepd. by treating SiCl_4 with H_2O . It was dialyzed in parchment paper, using a rapid dialyzer (cf. *C. A.* 16, 3236). One l. of this sol contained 3.525 g. of SiO_2 . It was dialyzed until no ppt. formed with AgNO_3 (60 hrs.). This pure sol was dialyzed with tap H_2O for 56 hrs. An analysis showed that 1.28% of the solids was CaO . Further dialysis with distd. H_2O removed the CaO so that in 64 hrs. no weighable amt. of Ca was present, and in 168 hrs. the spectrum of the sol had no Ca-lines. During these expts. the flow of the outer liquid was 3 l. per hr. When this rate was doubled the Ca was completely removed in 90 hrs. The distd. H_2O necessary to remove the Ca was greater than that necessary to remove the HCl originally present. However, when a sol contg. 0.81% SiO_2 was dialyzed 4 hrs. with tap H_2O 79.74% of the Cl ions were removed and 0.57% of the solid was CaO . The tap H_2O was replaced by distd. H_2O and the dialysis continued for 8 hrs. more. At the end of this time all of both Cl and Ca was removed. If the tap H_2O contains Fe it cannot be used because the Fe which enters the sol is subject to hydrolysis and produces $\text{Fe}(\text{OH})_3$ sol, which cannot be removed by dialysis.

F. E. BROWN

The significance of the hydrogen-ion concentration in the swelling of gelatin. WO. OSTWALD, A. KUHN AND E. BÖHME. *Kolloidchem. Beihefte* 20, 412-33 (1925).—The swelling of gelatin as a function of p_{H} value is studied for various acids and buffer solns. The observations are discussed in view of the results obtained and predicted by Loeb (Proteins and the Theory of Colloidal Behavior, New York, 1922), from which they differ in several respects: In spite of constancy in concn. and p_{H} , monobasic acids do not cause the same degree of swelling; with HCl the swelling is several times greater than with HCl. The H_2SO_4 swelling may exceed that of HCl, contrary to Loeb's rule. A very pronounced effect of the anion on the acid swelling of gelatin is ascertained, thus reviving the classical ion-series of Hofmann. In general, mixts. of acids and salts decrease the swelling as compared with the pure acids of same p_{H} . However, certain anions have such a marked effect that buffer solns. contg. them may cause the gelatin to swell even more than it does in the pure acid of same p_{H} . The isoelec. point of gelatin is not a const.; it varies for different brands of gelatin and is influenced by buffer solns.

This observation is said to account for discrepancies among previous authors in the detn. of the iso-elec. points of proteins.

Studies of the optical activity of gelatin systems. E. O. KRAEMER AND J. R. FANSELOW. *J. Phys. Chem.* 29, 1169-77 (1925); cf. *C. A.* 19, 1369.—The optical rotation of systems of Eastman's de-ashed gelatin was studied for p_c between 2.30 and 12.31, and for temps. between 10° and 50°. The relative light scattering capacities (or Tyndall effects) of the same systems were detd. The various hypotheses involving gel forms or sol forms or tautomeric changes which have been proposed from time to time to explain certain behaviors of gelatin systems, including optical activity, lack exptl. support, and are probably confusing rather than helpful. Many of the phenomena which have given rise to the speculations mentioned are due to the fact that gelatin sols and gels display the characteristics of polyphasic (colloidal) systems. The so-called mutarotation of gelatin systems reflects colloidal changes in the systems tending to gel formation. Influences which prevent gel formation also prevent mutarotation.

Electro-ultrafiltration of gelatin and glue. H. BECHHOLD AND A. ROSENBERG. *Biochem. Z.* 157, 85-97 (1925).—Gelatin and glue are purified by a process of electro-ultrafiltration which combines the use of the ultra-filter with the electro-dialyzer. The method may be applied to other disperse systems. Instead of the soln. of dispersoid becoming diluted, it is concd. A double filtration method is also described.

The action of ozone on aqueous colloidal solutions of inorganic substances. E. H. RIESENFELD AND W. HAASE. *Z. anorg. allgem. Chem.* 127, 188-95 (1925).—Ozone rapidly dissolves Ag sol with the formation of AgOH. From Hg sol Hg₂O is pptd. Au sol is only partially dissolved; the red color changes to blue in consequence of salt action of the dissolved Au compds. Although Cu₂O sol is quite stable toward O₃, PbO sol is easily oxidized. As₂S₃ sol is decomposed with the formation of H₃AsO₄. Sb₂S₃ sol reacts more slowly, yielding H₃SbO₄. S and H₂S are also produced. Bi₂S₃ sol is stable. The action of O₃ on the last 3 sols parallels the stability of the pentavalent compds. of the 3 metals in neutral soln. Ag₂S, HgS and CuS sols are dissolved by O₃ with formation of sulfates.

Turgoelectricity. W. KOPACZEWSKI. *Compt. rend.* 181, 244-6 (1925).—The dispersion of certain colloids and the swelling of gels produced color changes in certain indicators. This was ascribed to redistribution of elec. charges. To test this 2 platinized Pt filament electrodes, connected with an electrometer and amplifying relay, were introduced into a capsule, and the substance to be studied was added, followed by H₂O. Occasional oscillations of the electrometer resulted during the dispersion. Emulsoids produced no effect, fine powders slight, swelling of gels marked, and gelation (Et salicylate—H₂O or Al(OH)₃—AcOH) the greatest effect, about 0.0004 v. Similar momentary effects resulted on adding drops of electrolyte to H₂O. The phenomenon was called "turgoelectricity" and was ascribed to mech. dissociation of H₂O or electrolytes.

Solubility of urea in water. L. A. PINCK AND MARY A. KELLY. *J. Am. Chem. Soc.* 47, 2170-2 (1925).—Redetn. of the soly. of urea in water over the temp. range 0° to 70° shows the following values at intervals of 10°:

Temp. °	0°	10°	20°	30°	39.7°	50°	60°	70°
G. urea in 100 g. H ₂ O	67.0	84.0	104.7	136.0	165.4	205.0	246.0	314.6

These values are higher than the data of Speyers (*Am. J. Sci.* [4], 14, 293 (1902)).

Solubilities of the phosphates of zirconium and hafnium. G. HEVESY AND K. KIMURA. *J. Am. Chem. Soc.* 47, 2540-4 (1925).—Zr phosphate pptd. from 6 N HCl soln. has the compn. ZrO(H₂PO₄)₂; Hf phosphate is HfO(H₂PO₄)₂. Upon ignition 2 mols. of H₂O are lost in each case. The soly. of Zr phosphate at 20° in 6 N HCl is 0.00012 mol. per l. and of Hf phosphate 0.0009 mol. per l. In 16 N HCl the values are 0.00023 and 0.00012. For good analytical results these pptns. should be made with a great excess of phosphate and in cold soln.

Investigations of the phenomenon of partition. NICOLAS A. KOLOSOVSKII. *Bull. soc. chim.* 37, 372-81 (1925).—Although it was early realized by Berthelot that the coeff. of partition of a substance between two phases is a function of the total concn., the formulas proposed by Nernst and Henry do not take this into account. The distribution of H₂O₂ between H₂O and Et₂O at 18° was studied over a ten-fold concn. range, and it was found that $C = 15.0 - 1.43P + 0.057P^2$, where C is the coeff. of partition, p/p' , and P the total concn. of the H₂O₂. The concn., p , in the aq. phase and the concn., p' , in the Et₂O are related by the equation $p^{1.14} + 0.025p^2/p' = K$. To express the par-

tion of AcOH between H_2O and Et_2O , the following similar but more complicated equation was used. $p^{1.07 + 0.002P} - 0.008P^2/p' = K$. Data were obtained on the distribution of $FeCl_3$ between H_2O and Et_2O , but they were too erratic to be expressed algebraically. Published data on the distribution of propionic acid between H_2O and Et_2O lead to the equation $p^{1.2} - 0.007P/p' = K$. It is suggested that the form of equation used here, although purely empirical, can be used to express partition data accurately over a wide range of concentrations.

A. W. KENNEY

Some physical properties of aniline and its aqueous solutions. M. P. APPLEBEY AND P. G. DAVIES. *J. Chem. Soc.* 127, 1836–40(1925).—Purified $PhNH_2$ showed a blue fluorescence and phys. properties as follows: m. p. -5.98° , d_{20}^{20} 1.02315, n_D^{20} 1.58685, viscosity 0.04468. The decreases of these values by 1% H_2O were 2.6°, 0.00018, 0.0027, and 0.0026. The eutectic was at 2.575% H_2O and -11.85° . Association of both H_2O and $PhNH_2$ in mixts. was indicated.

A. W. FRANCIS

The vapor pressure of hydrogen chloride in aqueous solutions. I. SHINROKU MITSUKURI, TATSUO ROKKAKU AND TAKEO WATASE. *Sci. Repts. Tohoku Imp. Univ.* 14, 251–8(1925).—Air was passed through 3 saturators contg. HCl at 25° , and the vapors were condensed at 0° in a cond. cell. The partial pressure of HCl of the original solns. was calcd. from the cond. and the difference between the partial pressure of H_2O of the original solns. and the vapor pressure of H_2O at 0° . The concn. of HCl and the logarithm of the partial pressures in mm. were as follows: 0.517, -5.228 ; 0.929, -5.130 ; 1.533, -4.960 . These are much lower than those calcd. by extrapolation of results by Bates and Kirschman (*C. A.* 14, 241) and those from e. m. f. measurements of activity (*C. A.* 12, 15).

A. W. FRANCIS

Vapor pressures of solutions of phenol and water at 75° . J. B. FERGUSON AND W. S. FUNNELL. *Trans. Roy. Soc. Canada* [iii], 18, III, 122–3(1924).—The vapor pressure of mixts. of phenol and water (7–60% phenol) at 75° is almost independent of the compn. of the mixt.

B. C. A.

The surface tensions of aqueous phenol solutions. I. Saturated solutions. A. K. GOARD AND F. K. RIDEAL. *J. Chem. Soc.* 127, 780–7(1925).—Detns. were made by the drop-weight method, Iredale's methods of computation (*C. A.* 17, 2664) being used. 73.06 dynes/cm. is obtained for the surface tension of pure water at 20° . Measurements of the 2 liquid phases at 0° , 17° , 30° and 40° show the surface tensions of the phenol-rich phases to be higher and to approach those of the water-rich phase as the temp. rises. The curves approach at 68.8° (temp. of complete miscibility) is approached, and there is no evidence that they cross at a lower temp. as claimed by Morgan and Evans (*C. A.* 11, 2983). II. Activity and surface tension. *Ibid* 1668–76.—The activity of phenol in water soln. and in $NaCl$ -water solns. was detd. by measuring partition of phenol between the aq. solns. and paraffin oil at 20° , over the concn. ranges 0 to 25% $NaCl$ and 0 to satn. of phenol. The surface tensions of phenol- $NaCl$ -water solns. were also detd. by the drop wt. method. Adsorption of phenol in the soln.-air interface was computed by the Gibbs formula, making use of the activity in place of the concn. The max. adsorption corresponds to a single layer of phenol mols. at the surface, each mol. occupying 23.8×10^{-16} sq. cm. and oriented on edge. The thickness of the adsorbed layer is estd. at 6.4×10^{-8} cm. The presence of $NaCl$ raises the surface tension of phenol solns. in nearly the same degree that it raises that of pure water. This is not in harmony with the Langmuir-Harkins theory, in that the surface layer of closely packed phenol mols. cannot be solely responsible for the surface tension; the "foundation" layers must also be taken into account.

C. M. BOUTON

The precipitation laws. P. P. VON VEIMARN. *Chem. Rev.* 2, 217–42(1925).—A review in which the author discusses the numerical data relating to: (1) the laws of pptn., (2) the variables regulating the mean dimensions of the ultramicroscopic particles of disperse phases, (3) the process of dispersion, (4) the dependence on the soly. of a salt of the amt. of adsorption of this salt on a given adsorbent, and (5) the influence on the life of dispersoidal solns. of an increase in the concn. of electrolytes.

G. C.

A note on the precipitation of bismuth trisulfide from acid medium. S. RAMACHANDRAN. *Chem. News* 131, 135(1925).— Bi_2S_3 is not pptd. from solns. of HCl when the concn. of HCl is greater than 1 part concd. acid to 3 parts H_2O ; nor is pptn. complete in solns. stronger in acid than 1:5. Conversely, pure pptd. Bi_2S_3 is nearly completely sol. in 1:3 HCl at 30° .

M. O. LAMAR

Solubility relationships of isomeric organic compounds. IV. The mutual solubility of *o*-, *m*-, and *p*-nitroanilines and of *o*-, *m*-, and *p*-nitrochlorobenzenes. G. T. KOHMAN. *J. Phys. Chem.* 29, 1048–56(1925).—The m. ps. of the nitroanilines were redetd. and found to be: *o* 69.3° ; *m*, 111.8° ; and *p*, 147.5° . The mutual soly. of the 3 nitroanilines was detd. for the 3 binary systems and for the ternary system. The solubil-

ities as detd. exptly. were compared with the ideal solubilities as calcd. from calorimetric data. The comparison showed that the solns. were all very nearly, if not quite, ideal. The same m. p. and soly. measurements were made on the 3 isomeric chloronitrobenzenes. The m. ps. were: *o*, 32.0°; *m*, 43.4°; and *p*, 82.5°. An unstable form of the *m*-chloronitrobenzene, starting to melt at 23.7°, was observed. The soly. measurements for the 3 binary systems and for the ternary indicated that these solns. may be regarded as ideal. No calorimetric data on the solns. of the 3 isomers of chloronitrobenzene in naphthalene, benzene and aniline are assembled in tabular form. *m*-Chloronitrobenzene is obtained in 80–90% yields as follows: Dissolve 50 g. *m*-nitroaniline in 75 g. HCl (sp. gr. 1.19) and dil. with 225 g. H₂O. Cool to 0° and add slowly, with vigorous stirring, a soln. of 25 g. NaNO₂ in 70 g. H₂O, keeping the soln. of nitroaniline at 0°. Add the diazotized soln. slowly to a boiling soln. of 20 g. CuCl in 150 g. H₂O and 25 g. concd. HCl, keeping the diazotized soln. at 0°. The *m*-chloronitrobenzene is isolated by steam distn.

R. L. DODGE

The pressures of saturation at reduced equal densities. W. HERZ. *Z. anorg. allgem. Chem.* **145**, 378–80 (1925); cf. *C. A.* **19**, 3203.—Computation of the quotient p_{T_2}/p_{T_1} and p_{T_2}/p_{T_1} for a great number of solvents.

JOHN T. STERN

Critical miscibility and boiling point elevation. C. DRUCKER and H. WEISSBACH. *Z. physik. Chem.* **117**, 209–41 (1925); also *Z. Elektrochem.* **31**, 409 (1925).—Ebullioscopic detns. on solns. of NaI, urea, succinic acid, water, PhNH₂, naphthalene, azobenzene and acetanilide in mixts. of CS₂ and MeOH varied widely from the values calcd. by the mixt. rule. *Heats of mixing* of CS₂ and MeOH, detd. at 20°, were too small to account for the discrepancies, which must be ascribed to the influence of the solutes on the partial pressures. The total vapor pressure of mixts. contg. 2.47, 90.7, 93.1 and 95.7 mol. % MeOH was detd. for a range of over 40°. The partial pressures at 38.9° for 3 mixts. were detd. by condensation of a small sample of the vapor in a closed app., and analysis for MeOH by cryoscopic measurements in water. By an extension of the theory of Nernst for ebullioscopy in mixed solvents, the changes in partial pressures produced by the solutes were calcd. The influence of the solute on the partial pressure may be interpreted as a "salting-out" effect, 1 of the 2 liquids being rendered less vol. if the other, with a resulting increase in its relative partial pressure; the results are in accordance with the relative solubilities of the solute in the pure liquids. The crit. mixing temp. is altered by the addn. of the solute to a value corresponding to the altered partial pressure of one or the other of the solvents, depending on which side of the temp.-compn. curve the mixt. lies.

B. H. CARROLL

The influence of capillary-active substances on the surface tension of salt solutions, and its relation to the hydration of ions. WOLFGANG SEITH. *Z. physik. Chem.* **117**, 257–84 (1925).—The oscillating jet method was used for the detn. of surface tension of aq. solns. of MeOH, EtOH, iso-PrOH, iso-BuOH, iso-AmOH and PhNH₂ with varying concns. of NaCl, MeOH, EtOH and iso-BuOH with MgSO₄; iso-BuOH with KCl, MgCl₂ and BaCl₂; EtOH with LiCl and urea; PhNH₂ with LiCl. The effect of the capillary-active materials on the surface tension of the salt soln. increases with increasing concn. of the salt; plotting the surface tension of varying concns. of salt soln. against the concn. of active material in them, the curves meet in a point. By means of the Gibbs equation, the concn. of capillary-active material in the surface layer of the salt solns. can be calcd. from the lowering of surface tension; again by use of the Gibbs equation, the body concn. is found which would be in equil. with this surface concn. in the absence of salt. This is higher than the body concn. of the salt soln. computed from the vol. of soln. and amt. of capillary-active material; the difference is ascribed to hydration of the salt ions, which increases the effective body concn. The values obtained, in mols. of water per mol. of salt, are: KCl 14, NaCl 23, $\frac{1}{2}$ BaCl₂ 24; $\frac{1}{2}$ MgSO₄ 119. This computation is impossible when the salt is sol. in the active material; when it is insol., the surface tension of the mixed soln. may be expressed by a formula contg. a single const.

B. H. CARROLL

Diffusion of iodine in pure solvents and in mixtures of solvents. J. GRÖH and I. KÉLP. *Z. anorg. allgem. Chem.* **147**, 321–30 (1925).—The rates of diffusion of I in EtOH, C₆H₆, CHCl₃, CS₂ and Et₂O were measured for concns. of 0.5, 0.25, 0.10 and 0.05 mols. I per l. The measurements were made in a modified Ohm app. From the exptl. results the diffusion velocity consts. (expressed as cm.²/day) at infinite diln. and 10° ($D_{\infty 10}$) were calcd. by graphical extrapolation. The consts. ($D_{\infty 10}$) are EtOH, 0.831; C₆H₆, 1.411; CHCl₃, 1.736; CS₂, 2.517 and Et₂O, 2.595. It was hoped from these measurements to be able to attribute the brown color of I solns. in certain solvents to solvation of the I mols. If this were the case the product of the diffusion const. times the internal friction (η) of the solvent (Landolt-Börnstein) would be const. for violet

solns. and less for brown solns. The observed product $D_{\infty,10} \times \eta$ was const. for the violet solns. (C_6H_6 , $CHCl_3$ and CS_2), but was less for the brown Et_2O soln. and greater for the brown $EtOH$ soln., in contradiction to the solvation hypothesis. Comparative expts. on the rate of diffusion of I in mixts. of solvents were made. The mixts. used were: CS_2 with 0.5 and 1.0 mols. $Et_2O/l.$; CS_2 with 2.0 mols. $EtOH/l.$; and $CHCl_3$ with 2 mols. $EtOH/l.$ These quantities of Et_2O and $EtOH$ were sufficient to turn the solns. of I in CS_2 and $CHCl_3$ from violet to brown. The diffusion velocities in the mixed solvents were measured simultaneously with velocities in pure CS_2 and $CHCl_3$ to eliminate external influences. The decrease in diffusion rate caused by the Et_2O and $EtOH$ addn. was so slight that no definite conclusions with regard to the relation between solvation and color could be drawn.

R. L. DODGE

The ammoniation of ions in aqueous solutions. J. LOŠAN. *Rec. trav. chim.* **44**, 459-65(1925).—It is well known that like H_2O NH_3 acts upon many electrolytes combining as " NH_3 of crystn."; Clark (*C. A.* **18**, 921) describes such compds. as $CsCl \cdot (TiCl, BaCl_2, MnCl_2) \cdot nNH_3$. Even in aq. NH_4OH solns. Ag, Cd, Cu and Zn ions, as well as those of Mg, Mn, Co and Ni, exist as ammoniated ions (analogous to hydrated ions). To investigate how far some ions of the alkali and alkaline earth metals are capable of binding NH_3 from aq. solns. the f. p. method of following changes of osmotic pressure was used. Born (*C. A.* **14**, 1247) deduced that the solvation is due to the electrostatic attraction of the dipolar solvent mols. for the ions; since NH_3 has a greater sp. inductive capacity than H_2O , NH_3 mols. might be preferentially attracted from a mixt. of both. It was thought that when a certain amt. of NH_3 is added to a soln. of electrolytes, then if the ions of the electrolytes become ammoniated, the increase of the osmotic pressure and consequently the enlargement of the f. p. depression will be less than that which should be produced if none of the NH_3 added combined with the ions. Or, conversely, if to an aq. NH_3 soln. a salt which unites with NH_3 be added, the lowering of the f. p. will become smaller, the greater the quantity of NH_3 bound by the added ions. Both ways were tried. The results showed that the ions of Li and still more those of Mg must combine with NH_3 mols., since the lowering of the f. p. is considerably diminished below that theoretically expected. This ammoniation of these 2 smallest ions of these 2 groups becomes most striking in more concd. solns. of NH_3 , but here it is also masked by hydration. The value of the characteristic difference d , which with the chlorides of Li, Na, NH_4 and K in NH_3 solns. runs -0.115 , $+0.172$, $+0.221$ and -0.361 , becomes in glucose solns. $+0.744$, $+0.569$, $+0.445$ and $+0.307$. The real effect of the ammoniation of the ions must be regarded as proportional to the differences of the 2 given nos., viz. for Li 0.859, Na, 0.395, NH_4 , 0.198 and K 0.54. It evidently diminishes with the increase in the ionic vol. The results are in accordance with the fact that there is a considerable increase of soly. of NH_3 in solns. of Li and Mg salts and the small vapor tension of NH_3 in such solns. (Cf. Abegg, Riesenfeld, *Z. physik. Chem.* **40**, 84(1902); Gans, *Z. anorg. Chem.* **55**, 236(1900); Dawson and Crae, *J. Chem. Soc.* **79**, 493(1901)).

E. J. WITZEMANN

Precision determination of the electrical conductivities of concentrated aqueous solutions of calcium chloride. M. CROWE. *Trans. Roy. Soc. Canada* [iii], **18**, III, 339(1924).—Detns. of the elec. cond. of aq. solns. of $CaCl_2$ at concns. from 25 to 50% for temps. between 10° and 30° have been made, the accuracy being estd. as about 0.05%. Details will be published later.

B. C. A.

The conductivity of phosgene solutions of aluminium chloride at 25° , 0° , and -45° . A. F. O. GERMANN. *J. Phys. Chem.* **29**, 1148-54(1925).—The ordinary Kohlrausch method was used and the a. c. was produced by a simplified Vreeland oscillator. The results are given in curves and tables.

D. S. VILLARS

Solutions of ammonia. F. E. C. SCHEFFER and MISS H. J. DE WIJJS. *Rec. trav. chim.* **44**, 655-62(1925).—It is generally agreed that in an aq. soln. of NH_3 the mols. NH_3 and NH_4OH are present besides the ions of NH_4OH . Many consider that the ratio $NH_3:NH_4OH$ is large; that is to say, NH_4OH is a strong base. This hypothesis does not agree with the work of Moore (*C. A.* **2**, 16), who found $K_{mol.} = \frac{C_{NH_3}}{C_{NH_4OH}} = 0.5$ (15°). For reasons given it is concluded that NH_4OH is not a strong base. The equil. const. of M. (*loc. cit.*) for the reaction $NH_3 + H_2O \rightleftharpoons NH_4OH$ is then shown to be wrong and it is concluded that it is impossible at present to say anything about the position of this equil. Arguing by analogy from the behavior of alkylammonium bases in H_2O it may be concluded that since the strong base is obtained only with the tetraalkylammonium hydroxides the other bases are weak because the undissociated part consists largely of the anhydro base. Thus in the case of NH_3 there will be much NH_3 and little NH_4OH and this is the only existing indication concerning the position of this equil. The rest of the paper is given over to a detailed discussion of the application of Henry's

law and Boyle-Gay Lussac's law to solns. of NH_3 and the deductions concerning the equil. state: $(\text{NH}_3)_g \rightleftharpoons (\text{NH}_3)_d$ dissoed. that may be derived from these data. Two expressions are developed that are necessary for detg. the dissoc. const. of complex metal-ammonia ions. E. J. WITZEMANN

The composition and the stability of some metal-ammonia ions. MISS H. J. DE WIJS. *Rec. trav. chim.* **44**, 663-74 (1925).—The compn. and stability of metal-ammonia ions can be found by detg. the NH_3 pressure above solns. of these ions. From this pressure by the aid of equations given in the previous paper (preceding abstract) it is possible to deduce the concn. of free NH_3 in the soln.; by subtracting this value from the total concn. of NH_3 the amt. of combined NH_3 is detd. These data permit of deducing for solns. of various concns. of the salt and of NH_3 both the formulas and the dissoc. const. of the metal-ammonia ions, if the solns. do not contain too many different complex ions. In this paper de W. has tried to render an account of the behavior of metal-ammonia solns. by assuming the existence of as small a no. as possible of different ions. It is true, except in the case of Ag for which it is sufficient to admit the existence of a single complex ion, that at least 2 ions are necessary for all of the metals examd. and even 3 for Ni, in order completely to account for the results obtained. It is evident that the results may also be interpreted on the basis of more complicated assumptions. The NH_3 pressure was detd. by the dynamic method (Gahl, *Z. physik. Chem.* **33**, 178 (1900)), the details of which are given. The max. NH_3 content found for the ions investigated follows: $\text{Ag}(\text{NH}_3)_2^+$, $\text{Cu}(\text{NH}_3)_4^{++}$, $\text{Cd}(\text{NH}_3)_2^{++}$, $\text{Zn}(\text{NH}_3)_4^{++}$ and $\text{Ni}(\text{NH}_3)_6^{++}$. By selecting suitable concns. and adding NH_4NO_3 the stability const. K_c and K_c' for the equil. $\text{M}(\text{NH}_3)_n^{++} \rightleftharpoons \text{M}^{++} + n \text{NH}_3$ and $\text{M}(\text{NH}_3)_n^{++} \rightleftharpoons \text{M}^{++} + 4 \text{NH}_3$, resp., were detd. For Cd, $K_c = 2.7 \times 10^{-5}$, $K_c' = 2.5 \times 10^{-7}$; for Zn, $K_c = 1.4 \times 10^{-5}$, $K_c' = 9.8 \times 10^{-10}$; for Ni, $K_c = 2.4 \times 10^{-5}$, $K_c' = 4.8 \times 10^{-8}$, $K_c' = 2.1 \times 10^{-8}$. The solubilities of the hydroxides were calcd.: for $\text{Cd}(\text{OH})_2$, 2.8×10^{-14} , for Zn 7.4×10^{-17} , for Ni 1.6×10^{-14} . The stability const. of $\text{Ag}(\text{NH}_3)_2^+$ could not be detd. because the complex is so stable. E. J. WITZEMANN

Inter-ionic attraction theory of ionized solutes. III. Testing of the theory in alcoholic solvents. A. A. NOYES AND W. P. BAXTER. *J. Am. Chem. Soc.* **47**, 2122-9 (1925).—The accurate e. m. f. data existing in the literature that are suitable for calcg. the activations of ionized solutes in alc solvents have been summarized and utilized for this purpose. Activation values so derived for HCl in EtOH and in an equimolar mixt. of EtOH and water for LiCl in MeOH and EtOH, and for Na ethylate in EtOH have been used to test the inter-ionic attraction theory, assuming that the deviation resulted wholly from this source and not at all from incomplete ionization. The results are shown to be in general agreement with that theory as in the case of aq. solns.; and especially it is proved that the logarithm of the activation is, at least approx., inversely proportional to the three-halves power of the dielec. const., thus demonstrating the elec. origin of the effect. The actual numerical coeff. in the equation expressing the relation between activation and its parameters are, however, again found to be $1/2$ to $1/4$ less than the theoretical ones at 0.01-0.02 *N*, but they are changing with decreasing concn. in the direction of the theoretical limiting value. IV. **The influence of variation of dielectric constant on the limiting law for small concentrations.** P. DEBYE AND LÉO PAULING. *Ibid* 2129-34; cf. *C. A.* **18**, 190, 2453.—Neither the variation of the dielec. const. in the immediate neighborhood of the ions nor the deviation of the dielec. const. of the soln. in mass from that of the pure solvent has any effect on the limiting law for very dil. solns. of strong electrolytes. It is further proved that for such solns. the value of the ordinary dielec. const. for the pure solvent in mass is to be substituted. The expts. of Brönsted and Lamer (*C. A.* **18**, 1692) at very low concns. have completely confirmed this theoretical limiting law. The fact that some other exptl. results at fairly low concns. have led to smaller values of the numerical coeff. than those given by these equations can be attributed to variations of the dielec. const. only if it be assumed that the solns. investigated were still too concd. to make the limiting law strictly applicable. JAMES M. BELL

The acid character of saccharin and related acids. The detection and determination of *p*-sulfamylbenzoic acid in saccharin and crystalline. I. M. KOLTHOFF. *Rec. trav. chim.* **44**, 629-37 (1925).—Saccharin in H_2O behaves like a pretty strong acid and has therefore a dissoc. const. that diminishes with diln.: at 18° it is 2.5×10^{-3} . In abs. EtOH the const. at 15° is 1.2×10^{-6} . The first dissoc. const. of *p*-sulfamylbenzoic acid is 3.05×10^{-4} in H_2O ; the soly. product is 2.75×10^{-7} . The sulfamyl group has no basic properties but behaves like a very weak acid with a dissoc. const. of 6×10^{-11} . The first const. of *o*-sulfamylbenzoic acid is 2.7×10^{-3} ; the 2nd const. of *o*-sulfobenzoic acid is 1.2×10^{-4} . Simple methods for the detection and the detn. of *p*-saccharin (I)

in *o*-saccharin (II) and crystallose are given. 0.250 g. + 0.200 g. NaOAc \approx 3 cc. H₂O are warmed until completely dissolved. The soln. is then cooled and 5 drops of 4.0 N AcOH is added. The soln. is allowed to stand overnight. If more than 2% I was present in the sample of II needle-shaped crystals of I are found. If more than 4% of I are present crystn. begins within 15 min. The reaction may also be used for the detection of I in crystallose. With pure preps. no crystals are sepd. in this test. The reaction depends on the fact that with the H-ion concn. produced in these solns. II is almost completely present in the ionized form while I is almost completely unionized and since it is difficultly sol. it seps. The detection of I in crystallose is also easily accomplished by means of the SO₂NH₂ group. 0.5 g. pure crystallose in 3 cc. H₂O with 2 drops of a 0.1% nitramine soln. becomes orange-brown by the addition of 0.2 cc. 0.1 N NaQH. If the salt of I is present the SO₂NH₂ group is first neutralized and then only does the color change to orange-brown. In this way a com. sample of crystallose which failed to show I by any other test was found to contain 0.8% I. E. J. W.

The electrical conductivity of some dilute liquid amalgams. E. J. WILLIAMS. *Phil. Mag.* 50, 589-99 (1925).—Amalgams of Cd, In and Mg have been studied over a range of compn. and of temp. The results are summarized in a table which should be consulted for detailed data. S. C. LIND

Hydrolysis of iodine as measured by the iodine electrode. H. D. MURRAY. *J. Chem. Soc.* 127, 882-5 (1925).—To account for the hydrolysis of I in H₂O soln., dissociation into 2 oppositely charged ions from the I₂ mol. is assumed. Hydrolysis follows from the reaction $I^+ + H_2O = H^{+} + HIO$. In soln. there is an equil. between the I and HIO mols. and the ions H⁺, I⁻ and I₂⁻ which is derivable from the mass action laws $[I^+][I^-]/I_2 = K_1$; $[I^-][I_2]/[I_2^-] = K_2$; $[I^+][OH^-]/HIO = K_3$. Under conditions where any HI formed is largely dissociated $K_1 = ([I^-]^2/I_2) \{1 + (1/K_2) \cdot [I_2]/\{1 + (K_2/K_3) \cdot (1/[H^+])\}\}$. K_1 was detd. by means of an I-iodide electrode and K_2 was redetd. for solns. contg. KCl and H₂SO₄. The method of procedure is given in detail and the results are tabulated. The value for K_1 was found to be 0.97×10^{-8} at 25°. For the value $K_1 K_2/K_3 = [HIO][H^+][I^-]/[I_2]$ Bray (*C. A.* 4, 2758) obtained the value 3×10^{-3} from which K_2 was calcd. to be 3.2×10^{-10} at 25°. HARRY B. WEISER

Some aspects of chemical reactivity. W. C. M. LEWIS. *Chem. Weekblad* 22, 437-8 (1925).—A brief review of the 2 leading theories of the mechanism of chem. change—the radiation hypothesis and the collision hypothesis, with particular reference to the idea of "crit. increment" and to the significance of spectroscopic location of absorption bands in testing this idea. R. L. DODGE

Note on Mr. Garner's paper on the critical increment of chemical reactions. C. N. HINSHELWOOD. *Phil. Mag.* 50, 360-1 (1925).—H. defines the velocity const. k of a bimol. gas reaction as: $k = 2 \times \text{total no. of collisions} \times e^{-Q/RT} \times P$, where $e^{-Q/RT}$ is the fraction of the total no. of collisions when the energy is sufficiently great for combination, and P is the actual efficiency factor which by experience has been found to be approx. unity. Since the collision no. is proportional to \sqrt{T} , $k = \text{const.} \sqrt{T} e^{-Q/RT}$ or $d \log k/dT = (1/2T) + (Q/RT^2)$. H. shows that in irreversible reactions P may approach indefinitely close to unity. In reply to G.'s argument that because P is an unknown function of temp. the detn. of Q from the temp. coeff. of the reaction is not sound, H. emphasizes that the activated mols. by hypothesis have the same "temp." whatever the real statistical temp. be in the body of the gas and G.'s objection is therefore not valid. S. C. LIND

The kinetics of the oxidation-reduction partition of formaldehyde. HANS V. EULER and THOR LÖVGREN. *Z. anorg. allgem. Chem.* 147, 123-34 (1925).—The velocity const. of the reaction, $2HCHO \rightarrow MeOH + HCOOH$, under the influence of alkali at 50° with p_H 11 to 15, varied from 0.001 to 0.5. With const. p_H the reaction was bimol. and the active agent seemed to be the HCHO anion. The dissociation const. of HCHO at 50° was estd. as 3.3×10^{-14} . A. W. FRANCIS

The rate of addition of hydrochloric acid to quinone in methanol. LEONWIG EBBERT. *Z. Elektrochem.* 31, 113-23, 209 (1925).—The rather slow addn. of HCl to quinone yielding chlorohydroquinol which reacts instantly with quinone to form chloroquinone and hydroquinol, limits the use of the quinhydrone electrode in presence of HCl (*C. A.* 19, 2589). The rate of the slow primary reaction in methanol was measured by following (1) the change in cond. of the solns., (2) their change in light absorption, and (3) the change in the electropotential of the quinhydrone electrode. The slow reaction was found to be proportional to the product of the activities of H and Cl ions, and to be monomol. as respects quinhydrone when its concn. is small in comparison with that of HCl. Addn. of water decelerates the reaction. Equil. lies strongly on the side of the chlorinated compds. C. M. BOUTON

Sweet ice from sea water. CH. M. VAN DEVENTER. *Chem. Weekblad* **22**, 412-3 (1925); cf. following abstr. Polemical against van Laar. MARY JACOBSEN

Last reply to Messrs. Korevaar (I), van Deventer (II), and Lely (III). J. J. VAN LAAR. *Chem. Weekblad* **22**, 413-4 (1925).—Polemical. Cf. Korevaar, C. A. **19**, 2798, van Deventer, preceding abstr., and Lely, C. A. **19**, 2934. MARY JACOBSEN

Equilibria in fused salts. Reactions of fused alloys of alkalis and alkaline earths with their fused chlorides. K. JELLINEK AND J. WOLFF. *Z. anorg. allgem. Chem.* **146**, 329-87 (1925); cf. C. A. **18**, 2993; **19**, 789, 1084.—The expts. are made in a fire-brick crucible which has an electrode in the bottom of a new kind. A screw is cemented in and both ends are fused by an elec. spark for tightening. On this the electrode metals Pb, Sn, Sb or Bi are molten. For the electrolysis either 12-14 amps., resulting in a temp. of 1000-1200° are used, or 6-9 amps., which produce 900-1000°, regulated by a gas burner. The products, salts and metals, are analyzed by especially adapted methods in using an av. sample of the regulus and a part of the salt fusion adjoining it. The following equilibria are investigated: $\text{Ba} + \text{CaCl}_2 = \text{BaCl}_2 + \text{Ca}$ in Pb; $\text{Ba} + 2\text{KCl} = \text{BaCl}_2 + 2\text{K}$ in Sn, Sb and Bi; $\text{Ba} + 2\text{NaCl} = \text{BaCl}_2 + 2\text{Na}$ in Sn, Sb and Bi; $\text{Sr} + 2\text{NaCl} = \text{SrCl}_2 + 2\text{Na}$ in Sb; $\text{Ca} + 2\text{NaCl} = \text{CaCl}_2 + 2\text{Na}$ in Sb and Bi. The results are given in tables and curves, and compiled with the data from other investigations. If on the ordinate be plotted atom % of the metals and on the abscissa mol. % of their chlorides the curves follow the equation $x(1-y)/(1-x)y = \text{const.}$ The alkali metals participate in biat. state and their chlorides bimol., while the earth alkalis do not associate. In no case is total dissociation indicated. Comparison is made with measurements on amalgams in aq. solns. The equilibria are quite independent of the temp., the cathode metal and even of the presence of H_2O . In first approximation Dolezlek's mass law on the molal fractions is also valid for these heterogeneous equilibria. They are calcd. satisfactorily from the differences of the formation heats of the solid chlorides. From the equilibria const. the potentials of the pure, fused metals, dipping into their chloride fusions are calcd. The normal potentials of all alloys which are investigated do not differ by more than 0.04 v. The theory of electrolysis of ternary alloys from binary salt fusions is developed. JOHN T. STERN

Equilibrium in the systems: zinc chloride-pyridine; and cadmium chloride-pyridine. R. B. MASON AND J. H. MATHEWS. *J. Phys. Chem.* **29**, 1178-83 (1925).—The solubilities of ZnCl_2 and CdCl_2 in $\text{C}_5\text{H}_5\text{N}$ from 0° to 105° were detd. ZnCl_2 increased in soly. continuously, showing only one solid phase $\text{ZnCl}_2 \cdot 2\text{C}_5\text{H}_5\text{N}$. A new compd., $\text{CdCl}_2 \cdot 6\text{C}_5\text{H}_5\text{N}$, was identified, its transition temp. to $\text{CdCl}_2 \cdot 2\text{C}_5\text{H}_5\text{N}$ being 9°. A. W. FRANCIS

The law of depression of freezing points in metallic alloys. KÔTARÔ HONDA AND TOYOZÔ ISHIGAKI. *Sci. Repts. Tôhoku Imp. Univ.* **14**, 219-33 (1925) (in English).—The lowering of the f. p. of a pure metal is proportional to the concn. of the solute element, provided the soln. is dil. (not more than 2 at. % of the solute element). The lowering of the f. p. obeys the law of depression given by van't Hoff or Planck, $\delta T = [-RT^2(C_1 - C_s)]/m\lambda$. R is the gas const., T is m. p. of solvent, C_1 and C_s are concns. of the liquidus and solidus phases coexisting at a given temp., m is the mol. wt. of the solute, and λ is the latent heat of fusion of the solvent. In the case of binary alloys forming a simple eutectic C_s is zero. Heycock and Neville (*Trans. Roy. Soc. London* **189A**, 25 (1897)) showed that this law holds fairly well for such a case. The present authors show that the law holds also in the case of binary alloys forming a solid soln. Thermal data obtained by Tammann and his co-workers is used. In some cases, where existing data do not satisfy the law, new detns. were made. Thermal analyses were carried out on Cd-Cu, Cu-Cd, Cu-Pb, Pb-Ag, Zn-Cd, Zn-Tl, each of which forms a simple eutectic. (The solvent metal is the first member of the pair.) Similar analyses were made on Bi-Pb, Bi-Zn, Cd-Ag, Cd-Hg, Pb-Bi, Pb-Cd, Pb-Hg, Pb-Sn, Cu-Ni, Cu-Sn, Cu-Sb, Cu-Zn, Sn-Bi, Sn-Cd, Zn-Ag, Zn-Al, each of which forms a solid soln. The law was confirmed in every case. The at. depression, due to soln. of 1 g.-mol. wt. of solute in a given solvent, is a const. independent of the nature of the solute, regardless of whether a solid soln. is formed or not. As in the case of ordinary solns. the law can be used for the detn. of the mol. state of the solute present in soln. All solns. studied contained the solute metals present as monat. elements. R. J. HAVIGHURST

The physical state of catalysts. R. C. SMITH. *J. Phys. Chem.* **29**, 1116-8 (1925).—The activity of metal catalysts depends not only upon the sp. surface but also upon the phys. state of the surface of the metal. If the surface is amorphous the catalytic activity is greater than if it is cryst. Highly polished plates of Pt, Pd and Au decompose H_2O_2 , contrary to the observation of Spring (*Z. anorg. Chem.* **10**, 161 (1895)). If the surface is crystd. by heating or by etching, a decrease in the catalytic effect is found. Wash-

ing with H_2O or alc. or contamination with grease also decreases the activity.

F. L. BROWNE

Interaction of hydrogen and carbon dioxide on the surface of platinum. C. R. PRICHARD AND C. N. HINSHELWOOD. *J. Chem. Soc.* **127**, 806–11(1925).—At 1000° when the pressure of CO_2 is kept const. the rate of formation of CO increases almost linearly with the pressure of H at least up to 300 mm. At const. H pressure, the rate of reaction is at first proportional to the pressure of CO_2 and then passes through a max. when the pressure of CO_2 is approx. double that of H. Large pressures of CO_2 have a greater retarding influence on account of its relatively strong adsorption by the catalyst. CO has a slight retarding influence. When the reacting gases are in equimol. proportions, the pressure of each being 100 mm., the course of the reaction is very nearly unimol.; but this result is to some extent a coincidence. A simple mechanism which accounts for most of the observed facts is that reaction occurs when H and CO_2 become adsorbed adjacent to each other on an active part of the surface. It must be assumed also, that the fraction of the active surface covered by CO_2 increases from 0° to 400° mm., while the adsorption of H at these points left free from CO_2 is never very great so that the zone of reaction is in that portion of the H adsorption isotherm where adsorption is more or less directly proportional to pressure.

HARRY B. WEISER

Studies on catalytic action. X. A comparative study of the catalytic activity of reduced copper, reduced nickel, and thoria. I. SHIGERU KOMATSU AND BUNKICHI MASUMOTO. *Memoirs College of Science Kyoto Imperial Univ.*, Series A, vol. **9**, 15–21 (1925) (in English); cf. *C. A.* **18**, 2156; **19**, 1804, 2590.—The catalytic actions of reduced Cu, reduced Ni and ThO_2 on hexahydrophenol at 200° and 300° were studied and their activities compared by detg. the yields of reaction products in each case. As oxidizing catalysts the activities stand in the order, $Ni > Cu > ThO_2$; as dehydrating catalysts $ThO_2 > Cu > Ni$. The ratio of oxidation to dehydration products at 200° and 300° , resp., for Ni is 16.24 and 21.73; for Cu 1.74 and 1.46; for ThO_2 1.65 and 0.12. In oxidation with Ni, H of the hexamethylene ring is split off; with ThO_2 , H of the OH group and with Cu both H atoms. Temp. influences the activity most with ThO_2 and least with Cu. The optimum temp. for catalytic activity seems to be 200° for Cu, 300° for ThO_2 , and somewhere between for Ni. With Ni the yield of oxidation products is increased and that of dehydration products decreased at the higher temp.; with ThO_2 the reverse is the case while Cu occupies an intermediate position.

F. L. B.

Acid catalysis in lactone formation. H. S. TAYLOR AND H. W. CLOSE. *J. Phys. Chem.* **29**, 1085–98(1925); cf. *C. A.* **11**, 1181; **17**, 2219.—The velocity of lactone formation from $MeCHOHCH_2CH_2COOH$ and *o*-hydroxymethylbenzoic acid has been studied in acid H_2O and Et_2O solns., at various temps. and in presence of neutral salts; and compared with the p_H from cond. measurements. The formula for monomol. reaction considering the equil. at 92.5% lactone was used. In H_2O the reactions showed the same characteristics as hydrolytic reactions with esters, with slight abnormal variations with acid concn. and neutral salt effect, and temp. coeff. 2.56 for 10° interval. In abs. Et_2O contg. HCl the rate was slower than in H_2O soln., but in wet Et_2O the rate was much greater. This proves that the velocity is not dependent upon the solvent, nor the undissociated HCl, nor the H-ion concn. as estd. by cond., but may depend upon the thermodynamic activity of the H ion, which may correspond to the concn. of unhydrated ion.

A. W. FRANCIS

Catalytic decomposition of hydrogen peroxide in an acid chlorine-chloride solution. R. S. LIVINGSTON AND WM. C. BRAY. *J. Am. Chem. Soc.* **47**, 2069–82(1925).—The steady-state rate of the chlorine-chloride decomp. catalysis of H_2O_2 is measured at 25° in solns. of HCl of concns. varying from 0.06 to 4.80 M. Rates in solns. contg. NaCl or $HClO_4$ in addn. to HCl are also measured. At the steady state in solns. of ionic strength less than 1.0μ the rate of decomp. of H_2O_2 is represented by the following equation within the limits of exptl. error: $-d[H_2O_2]/dt = (0.000101 \pm 0.000005) [H_2O_2] [H^+] [Cl^-] \gamma^2_{HCl}$. In more concd. solns. a negative departure occurs. Other rate equations are examd. and are shown to be less satisfactory. The steady-state Cl concn. is detd. for solns. whose HCl concn. varies from 4.55 to 5.86 M, and it is shown that the following relation between the steady-state concns. holds with reasonable accuracy: $1.5 \times 10^{-3} = [Cl_2]/[H^+]^2 [Cl^-]^2 \gamma^4_{HCl}$. A mechanism consistent with the steady-state measurements and analogous to that detd. for the Br-bromide catalysis is suggested. The rate of reaction of H_2O_2 with $HClO$ is very great and of the same order of magnitude as that with $HBrO$. The time required for the concn. to reach any fractional part of its steady-state value, and the relation between this fraction and the measured rate are discussed. An equation relating this time interval and the initial concns.

of H_2O_2 and HCl is derived. In several respects these conclusions differ from those of Maass and Hiebert (*C. A.* 18, 795). JAMES M. BELL

The logistic or autocatalytic grid. E. B. WILSON. *Proc. Nat. Acad. Sci.* 11, 451-6 (1925).—The advantage is pointed out of plotting paper in which the autocatalytic curve $y = L[1 + e^{-n(t-t_0)}]$ is represented by a straight line. F. R. B.

The stability relations of modifications in the polymorphous system, Al_2SiO_5 . FRITZ NEUMANN. *Z. anorg. allgem. Chem.* 145, 193-238 (1925).—Three natural Al silicates, sillimanite, disthene and andalusite, and a synthetic sillimanite were studied. The minerals were purified by suitable washing, reduced almost to colloidal size, and the heats of soln. in 40% HF detd. in a Pt calorimeter with elaborate precautions. The heats of soln. in cal./mol. at 15° are for SiO_2 33.95, andalusite 90.13, disthene 89.67, sillimanite 83.42, synthetic sillimanite 83.67. From these data the heats of mutual conversion were calcd. The mean sp. hts. between 0° and various temps. from 800° to 1400° were detd. similarly. The results in the 0-300° and 0-1400° ranges are for andalusite 0.2336, 0.2667; disthene 0.2256, 0.2740; sillimanite 0.2160, 0.2647. The sp. heats and mol. heats at various temps. were calcd. from these integral values. These approach 0 at the abs. 0°, but at very low temps. disthene has much the lowest sp. heat. All these data permitted the calcn. of $U-U_0$ and from the latter, the $A-U$ diagrams of the mutual systems were derived. In the disthene-sillimanite diagram A increases continuously, showing that disthene is always unstable. The andalusite-sillimanite diagram shows an enantiotropic conversion point ($A = 0$) at $1487^\circ \pm 180^\circ$. Since, however, decompn. to mullite and SiO_2 occurs at 1545° (within exptl. error of the other), there may be no stable existence for andalusite, and attempts to prep. it failed. A. W. FRANCIS

Heats of formation of phenol-water solutions at 75°. J. B. FERGUSON AND W. B. HOPE. *Trans. Roy. Soc. Canada [iii]*, 18, III, 121 (1924).—The max. heat effect occurs at approx. 61% phenol by weight and is 5.0 cal./g. of soln. (heat absorbed). B. C. A.

Heats of solution and dilution of salts from infinite dilution to saturation. I. Alkali halides: potassium chloride, potassium bromide, potassium iodide, sodium chloride, sodium bromide and sodium iodide. J. WEST AND E. LANGE. *Z. physik. Chem.* 116, 161-214 (1925); cf. *C. A.* 19, 769.—W and L describe an adiabatic calorimeter accurate within 3 g. cal., of which the water equiv. is detd. electrically and which can be used to measure isothermal heat absorptions or evolutions. The isothermal heats of soln. and of diln. of KCl , KBr , KI , NaCl , NaBr and NaI are detd. at 25.00° over the total range of solubilities. GEORGE CALINGAERT

Some remarks concerning lattice-energies, heats of hydration and heats of solution. E. LANGE. *Z. physik. Chem.* 116, 337-49 (1925).—The lattice energies of the alkali halides are calcd. from the heats of soln. detd. by West and Lange (preceding abstr.). By inserting the values thus obtained in Born's formula for the lattice-energy, L. arrives at the conclusion that the coeff. of repulsion in this formula is not a const. for all Ni and K halides. The heat of hydration of the ions is calcd. for a std. aq. soln. of NaI , and an attempt is made to deduct a kinetic explanation for the observation that the "last heat of soln." is negative when the soly. increases with the temp. P. K. F.

The heat of mixing for condensed systems. J. J. VAN LAAR AND R. LORENZ. *Z. anorg. allgem. Chem.* 146, 42-4 (1925).—The heat of mixing for condensed systems is calcd. using the authors' equation for the thermodynamic potential (cf. following abstr.). PER K. FRÖLICH

Derivation of the fundamental equations of the law of mass action for condensed and heterogeneous systems. J. J. VAN LAAR AND RICHARD LORENZ. *Z. anorg. allgem. Chem.* 145, 239-50 (1925).—For equilibrium in a system, the sum of the molar thermodynamic potentials of the components must be equal to zero. The molar thermodynamic potential is the increase of potential in a system when 1 mole of one component is added to a great mass of the original mixt., without appreciably changing the compn. of the system. The authors give a mathematical derivation of the expression for the molar potential, starting with the thermodynamic potential of the system as a whole. The treatment is first confined to the case of a perfect gas, then extended to include condensed and heterogeneous systems by the use of van der Waals' equation. R. J. H.

Kinetics in the pyrolysis of the permanganates. E. MOLIS AND M. CRESPI. *Anales soc. españ. fis. quim.* 23, 198-216 (1925).—Detailed data are given regarding the rate of the thermal decompn. of KMnO_4 and AgMnO_4 , their behavior being typical of other permanganates. This was detd. by measuring the rate of evolution of O_2 from the heated permanganate, the reaction being conducted to completion in each case. The reaction is autocatalytic, positive and compound, and is represented accurately by the equation, $dx/dt = [k_1 + (k_2x/u)](a-x)$, x being the vol. of O_2 formed in the time

t. This is a slightly modified form of Zawidzki's equation for autocatalytic reactions, $dx/dt = (k_1 + k_2x)(a-x)$, (*Bull. acad. sc. Cracovie* 1916, p. 275-329). Initially there is only the simple evolution of O_2 corresponding to $dx/dt = k_1(a-x)$. Immediately thereafter, the reaction is catalyzed by the products formed, $dx/dt = (k_2x/a)(a-x)$, and this effect soon predominates and passes through a max. If the permanganate is mixed with products of the reaction before heating, the course of the reaction is not typically autocatalytic, because of the presence initially of the catalyst. The autocatalytic process is accelerated by moisture; and increasing the temp. of decompn. accelerates the autocatalytic decompn. more than it does the simple decompn. The total velocity of decompn. of the permanganates of Ag, Cd, K, Na, Ba and Li increases proportionately to the heat of formation of the corresponding oxide. The preponderance of the autocatalytic effect over the velocity of the non-catalyzed reaction is most marked for Li, somewhat less for Cs and Rb, considerably less for K, Na and Ag, and only 3 times greater for Ba and Ca. If $KMnO_4$ is mixed with an equal wt. of its decompn. products, its initial decompn. temp. falls from 238° to $190-200^\circ$; and similarly, that of $AgMnO_4$ from 110° to 85° . Temp. at which other permanganates decompose, and the time required for complete decompn. are: Cd, 93° , 130 min.; Na, 170° , 110 min.; Cs, 320° , 70 min.; Rb, 290° , 60 min.; Ba 215° , 60 min.; and Li, 180° , 50 min.

R. H. LOMBARD

Is the saponification of esters derived from strong acids accelerated by the hydrogen ion? Concerning a criticism by M. Skrabal. S. C. J. OLIVIER AND G. BERGER. *Rec. trav. chim.* 44, 643-51 (1925).—Skrabal, Pfaff and Airoldi (*C. A.* 19, 244) recently criticized the conclusion of Olivier and Berger (*C. A.* 17, 1783) that the hydrolysis of esters of strong acids is not activated by the H ion. In this paper the objections are enumerated and answered in detail.

E. J. WITZEMANN

Studies of chemical action on crystals. (Edited by) F. Rinne. VIII. Solution and growth phenomena of borax. RUDOLPH GRAFE. *Ber. Verhandl. Akad. Wissenschaften* 76, 275-93 (1924).—Using distd. water as an etching agent the resulting etch figures and light figures for borax confirm its assignment to the monoclinic prismatic class of crystals. The solvent action of water checks the symmetry and resulting etching zones of the borax crystals.

W. H. STRAIN

Phase rule. L. GAY. *Bull. soc. chim.* 37, 941-70 (1925).—A lecture. J. M. B.

The composition of the liquid and vapor phases of mixtures of glycerol and water. M. P. I. V. IYER AND F. L. USHER. *J. Chem. Soc.* 127, 841-4 (1925).—The comps. of liquid and vapor phases are given for liquid mixts. varying from 75% glycerol (vapor phase 0.2% glycerol) to 100% glycerol. Even when the liquid contains 98% glycerol, the vapor contains only 1.7%. Analyses of the liquid phase and the condensed vapor phase were made by refractometer, for calibration of which the *ns* of glycerol-water mixts were detd. at 25° over the entire range of compn.

C. M. BOUFON

Binary system consisting of *o*-cresol and *p*-cresol. A. E. HILL AND IRVING MOSBACHER. *J. Am. Chem. Soc.* 47, 2544-5 (1925).—*o*-Cresol (m. 30.08°) and *p*-cresol (m. 34.8°) form a solid 1:1 compd. with a congruent m. p. of 7.8° existing between the limits of 37 and 59% of *o*-cresol. The eutectics of the compd. with *o*-cresol and *p*-cresol, resp., are at 0° and 1.57° .

JAMES M. BRILL

Zenith temperature. J. W. MELLOR. *Trans. Ceram. Soc. (England)* 23, 13 (1924).—The max. possible temp. calcd. on the basis of the kinetic and quantum theories is 4×10^{12} degrees abs.

WM. B. PLUMMER

The method of Willard Gibbs in chemical thermodynamics. W. LASH MILLER. *Chem. Rev.* 1, 293-344 (1924-5).—M.'s aim is to bring to the attention of the chemist the wealth of information to be derived from Gibbs' classic on heterogeneous equil. Gibbs' method is exact, makes no arbitrary assumptions regarding the nature or mechanism of the reactions involved in a given process, and supplies eqns. sufficient to solve any chem. problem, provided the necessary data are available. When the data are lacking, it indicates the best way to obtain them. Mol. and kinetic hypotheses are unnecessary in the thermodynamic methods of dealing with chem. problems. In order to be able to apply thermodynamics, it is, however, necessary that the student possess a knowledge of the specialized mathematics involved, viz., the general theory of partial differentiation, and the theory of the integrals. M. writes down, with help of Euler's theorem on homogeneous functions [cf. Mellor, "Higher Mathematics," p. 75. Abstr.] and the theorem on order of differentiation in forming second derivatives, 3 sets of second derivatives of a homogeneous function of first degree such as V , with respect to the independent variables p , T , and comps. These are classified as (1) mathematical, (2) phys., and (3) chem., according to whether (1) no restrictions are placed on the independent variables, (2) comps. remain const., or (3) p and T are const. Such sets of second derivatives can be

written down by rule for any function, for any set of variables, and hence supply a sufficient set of relations between the variables. A certain no. of these derivatives can be always expressed in terms of the others. In the next section M. considers the usual thermodynamic functions. He points out that the only essential functions are the ϵ and η of Gibbs, defined by the first and second laws, and depending solely on the initial and final states of a system. All other thermodynamic functions have been evolved for convenience of operation. They are listed, together with their derivatives, in order, and symbols used by various authors are given in footnotes for convenience. Reference to Gibbs' eqns. is made by no. In the remainder of the paper M. discusses Gibbs' criteria of equil. and their application to special cases of 2-component 2-phase systems.

F. C. KRACEK

The electro-kinetic and the thermodynamic potential. H. FREUNDLICH AND G. ERTSCH. *Z. physik. Chem.* 116, 401-19(1925).—Comparative measurements of the electro-kinetic and of the thermodynamic potentials are made for various types of salts against Jena-glass. The curve representing the electro-kinetic potential as a function of the salt concn. shows a max. as well as a point where the sign of the potential is reversed. The effect of the ion carrying the same charge as the glass is prevalent at the lower concns., while, with increasing concn. the effect of the ion having the opposite charge becomes more pronounced. The variations in the thermodynamic potential do not follow the same rule and the corresponding potential-concn. curve has a course which must be termed normal with respect to the conditions of the expts.

P. K. F.

The thermodynamic properties of calcite and aragonite. H. L. J. BÄCKSTRÖM. *J. Am. Chem. Soc.* 47, 2432-42(1925); cf. *C. A.* 15, 1475, 2224.—From measurements of the heats of soln. of calcite and aragonite in HCl, the difference, which is the heat of transformation of aragonite into calcite, is $\Delta H_{298} = 30 \pm 20$ cal./mol. The value of the heat of soln. for calcite is 4490 cal./mol., for aragonite 4470 cal./mol. in pure 1 N HCl; the corresponding values in HCl previously satd. with CO_2 are 3245 and 3204 cal./mol. The heat of soln. of CO_2 is therefore $\Delta H_{298} = 4965$ cal./mol. ΔS_{298} for the transformation aragonite \rightarrow calcite from this detn. of ΔH_{298} and the author's previous value for ΔF_{298} ($= -190$ cal./mol.) is 0.74 cal./deg. From the author's previous value of $d\Delta F/dT$, $\Delta S_{298} = 2.9$ cal./mol.; it is possible that this value is in error by as much as 2.2 cal./mol. Consideration of existing data on the sp. heats of calcite and aragonite yields $\Delta S_{298} = 2.4$ cal./deg. This also is probably in error, for the values of c_p for calcite at low temp. do not follow Debye's eqn.; aragonite values apparently are satisfactory. The heat content of calcite appears to be raised measurably by grinding. The paper also contains sp. directions for the calibration of multiple thermals for use in calorimetric work.

F. C. KRACEK

The heat of dissociation of calcium carbonate and the entropy of carbon dioxide. H. L. J. BÄCKSTRÖM. *J. Am. Chem. Soc.* 47, 2413-9(1925); cf. preceding abstr.—The heat of soln. of CaO in HCl satd. with CO_2 at 25° is 46,200 cal./mol. Combination with the heat of soln. of calcite in HCl under similar conditions gives $42,600 \pm 200$ cal./mol for the heat of dissocn. of calcite at 25° . From this value of ΔH_{298} and existing sp. heat data on calcite, the exptl. data of Johnston (*C. A.* 4, 2757) and Smyth and Adams (*C. A.* 17, 2221) on the dissocn. pressure of calcite can be represented accurately by the eqn. $\log p_{\text{mmHg}} = -9212.4/T + 1.6797 \log T - 1.5048 \times 10^{-3}T + 1.503 \times 10^{-7}T^2 + I$ ($I = 7.161$, Johnston; 7.1635, S. and A.; mean value 7.162; if pressure is expressed in atm $I = 4.281$.) The free energy eqn. for $\text{CaCO}_3 = \text{CaO} + \text{CO}_2$ then becomes $\Delta F = 42,180 - 3.34 T \ln T + 6.89 \times 10^{-3}T^2 - 6.88 \times 10^{-7}T^3 - 19,601T$; $\Delta F_{298} = 31,258$; $\Delta S_{298} = 31.05$. The value of ΔS_{298} for CO_2 is somewhat uncertain, probably lying between 48.3 and 50.85 cal./deg.

F. C. KRACEK

Heat of formation of lead carbonate. A. L. MARSHALL AND B. BRUZS. *J. Phys. Chem.* 29, 1184-6(1925).—The heats of soln. of PbO , $\text{PbO} \cdot \text{PbCO}_3$, and PbCO_3 (cerussite) in HNO_3 (50% by vol.) are, resp., 7.41, 8.54 and -1.99 kcal./mol., accuracy about 3%. The heats of the following reactions, $\text{PbO} + \text{CO}_2 = \text{PbCO}_3$ and $\text{PbO} + \text{PbCO}_3 = \text{PbO} \cdot \text{PbCO}_3$, are therefore -21.1 and -0.34 kcal., resp.

F. R. B.

The Nernst heat theorem. F. HENNING. *Z. physik. chem. Unterricht* 38, 169-73 (1925).—Brief résumé.

M. BEBER

The thermal dissociation of calcium carbonate and the differential method. II. LEONID ANDRUSSOV. *Z. physik. Chem.* 116, 81-96(1925); cf. *C. A.* 19, 1803.—The app. and method earlier described have been used, with some improvements in the furnace, to study the kinetics and equil. of the dissociation and association of different forms of CaCO_3 . There was a great difference in the velocity of reaction of the different forms. Water vapor accelerates the reaction between CaO and CO_2 . The thermal cond. and purity of the solid phase are significant factors. Consistent results were best ob-

tained with a prepn. which had been repeatedly formed and decomposed. The dissociation pressure between 506° and 902° is represented by the equation $\log p = -(8731/T) - 0.000866T + 1.75 \log T + 6.0808$. In general, A.'s results lie appreciably above those of other workers, even where the others are in good general agreement. The true chem. const. of CO_2 is calcd. from the equil. data as 1.035 ± 0.1 . A. W. KENNEY

Initial rate of decomposition of nitrogen pentoxide. E. C. WHITE and R. C. TOLMAN. *J. Am. Chem. Soc.* **47**, 1240-55(1925).—The reaction mixt. consisted of freshly prepd. N_2O_5 mixed with $\text{O}_2 + \text{O}_3$, the latter reoxidizing the decompn. products until exhausted, when the unrestricted decompn. commences. The decompn. was followed by colorimetric detn. of NO_2 in the mixt., the method having an accuracy of 5% at concns. of NO_2 as low as 0.27 mm. The decompn. was found to be unimol. in its initial stage, as was previously known to be the fact after that stage. No evidence was found of the autocatalytic effects apparently observed by Daniels, *et al.* (cf. *C. A.* **15**, 976; **17**, 13). Values of $k \times 10^3$ detd. for initial concns. of N_2O_5 in the range 1.3-55.0 mm. were 1.03 (20°), 2.19 (25°), 8.37 (35°) and 14.8 (40°). WM. B. PLUMMER

Thermal decomposition of nitrogen pentoxide. H. S. HIRST. *J. Chem. Soc.* **127**, 657-71(1925).—The rate of decompn. was detd. by detn. of the pressure change. Starting with pure N_2O_5 at initial pressures of 55-195 mm. the observed velocity const. $k \times 10^3$ (at 47°) varied irregularly from 34.7 to 39.3; in the presence of A in the starting mixt. it varied from 34.7 to 39.3; in the presence of O_2 from 35.9 to 38.3; in the presence of excess NO_2 from 35.6 to 36.7; and in the presence of moist air was 36.5. No evidence of autocatalytic effects was observed, the concordance of k under the above various conditions confirming this. Detns. of $k \times 10^3$ at 34.5° gave an av. value of 7.11, or a temp. coeff. of over 300% for 10° rise, which also argues against the presence of catalytic effects. WM. B. PLUMMER

An amendment to the Lyons decisions (1922) regarding the thermochemical standard substance. P. E. VERKADE. *Rec. trav. chim.* **44**, 800-4(1925) (in English).—The continued improvement in the accuracy of detns. of heat of combustion makes it essential to come to an agreement regarding the temp. at which the heat of combustion of BzOH , fixed internationally at 6324 cal. 15° per g. (air), will hold. For this purpose it is proposed to choose a temp. in the neighborhood of 20°. In the previous work from this lab. it was assumed that the above mentioned heat of combustion holds for an isothermal reaction at 19.5°. If it is at all possible the isothermal heat of combustion of substances to be investigated should always be detd. at this same temp. New abs. detns. of the isothermal heats of combustion of BzOH and salicylic acid at different temps. are desirable. The temp. coeffs. of the heats of combustion of BzOH and salicylic acids have been calcd. E. J. WITZEMANN

Electrolytic preparation of hydrogen sulfide and of metal sulfides. P. FISCHER. *Z. Elektrochem.* **31**, 285-6(1925).—Using as cathode a fused 50% mixt. of CuS and S with low sp. resistance an abundant evolution of H_2S is obtained in neutral or slightly acid solutions. If pure Cd is used as anode (Na_2SO_4 soln. electrolyte) CdS is formed in almost theoretical yield, at low c. d. in the yellow modification, at high c. d. more of the orange form. During the electrolysis the cathode decomposes; the S which apparently ionizes easily is being used up leaving a residue of CuS . B. J. C. v. d. H.

Electrolytic preparation of selenides and iodides. P. FISCHER. *Z. Elektrochem.* **31**, 286-7(1925).—For the prepn. of selenides a cathode consisting of a fused mixt. of 5 parts Sn or Cd with 1 part Se is well suited. With c. d.s. of 0.1-0.2 amp./cm.² no H_2 is evolved and no Se dispersed; polyselenides are formed at the anode. The valence of the dissolving Se could not be easily detd.; for ZnSe formation 0.74, for Ag_2Se 0.45 was found. Several expts. were made with iodine cathodes; a Pt cathode covered with solid I_2 short-circuited with a Pb anode in 5% KNO_3 soln. yielded PbI_2 cathodically. B. J. C. VAN DER HOEVEN

Oxidation and reduction. H. P. CADY AND ROBERT TAFT. *J. Phys. Chem.* **29**, 1057-74(1925).—C. and T. have further confirmed the concept of oxidation and reduction as a direct transfer of elec. charges without the actual formation, resp., of O and H by carrying out the electrolytic reduction of substances contg. no H in a solvent free from H , and by carrying out the electrolytic oxidation of substances contg. no O in a solvent contg. no O . The solvents that fulfilled most satisfactorily the requirements of this investigation were POCl_3 and NH_3 . The methods employed were similar to those described by Cady and Taft (cf. following abstr.). Qual. detns. of the soly. of several compds. in POCl_3 gave the following results: appreciably sol., I_2 , KClO_4 , KBrO_3 , KIO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$, K_2CrO_4 , AsBr_3 , FeCl_3 , CuBr ; slightly sol. KClO_4 , KIO_4 , $\text{Hg}(\text{CN})_2$; insol. KNO_3 , HgCl_2 , $\text{K}_2\text{Fe}(\text{CN})_6$, $\text{K}_2\text{C}_2\text{O}_4$, CuCl_2 , MnCl_2 . The POCl_3 was completely freed from HCl by distn. over metallic K . In the cases of electrolysis of

solns. of KIO_3 and FeCl_3 in POCl_3 proof was obtained of the anodic reduction of the dissolved salts in the absence of H, the former liberating I_2 and the latter forming ferrous ions. Reduction of chromates dissolved in POCl_3 was not evident. The oxidation expts. were carried out with solns. of TiI , CuI , hydrazobenzene and amine hydrochloride in liquid NH_3 . Proof of the oxidation was obtained in the case of the TiI and hydrazobenzene solns., the former yielding thalious ions and the latter azobenzene. Oxidation of the CuI and amine solns. was not definitely proved.

R. L. DODGE

Electrolysis in liquid sulfur dioxide. H. P. Cady and Robert Taft. *J. Phys. Chem.* **29**, 1075-84 (1925); cf. preceding abstr. With bibliography.—The compds., KIO_3 , $\text{Na}_2\text{S}_2\text{O}_3$, $\text{Ce}(\text{NO}_3)_3$, BaO_2 , K_2S , KBrO_3 , NaCN , $\text{Ca}(\text{ClO}_3)_2$, KClO_3 , AgNO_3 , $\text{K}_2\text{Cr}_2\text{O}_7$, $\text{K}_3\text{Fe}(\text{CN})_6$ were found to be equal sol. in liquid SO_2 . The substances, KClO_4 , $\text{Ca}(\text{NO}_3)_2$, $(\text{NH}_4)_2\text{MoO}_4$, Cr_2O_3 , Ca_3P_2 , KMnO_4 , KOAc , K_2CrO_4 , Na and H_2BO_3 were insol. Electrolyses of KCNS , KIO_3 , $\text{Fe}(\text{ClO}_3)_3$, KClO_3 , $\text{K}_3\text{Fe}(\text{CN})_6$ and KI in liquid SO_2 led to the conclusion that anodic processes are in general similar to those of the same substances in aq. solns. and that cathodic processes involve only reduction of the ions of the solvent.

D. S. VILLARS

Electrolysis of Fehling solution. L. Barth. *Z. physik. chem. Unterricht* **38**, 204-5 (1925).—With a U-tube as an electrolytic cell, Cu , CO and C_2O_2 are formed at anode. At the cathode, the K formed decomposes the H_2O and the H_2 produced reduces the Fehling soln., yielding CuOH and then Cu_2O so finely divided that it forms a colloidal soln. when shaken with water.

M. BEBER

Intermittent-current electrolysis. II. Overvoltage study of the lead electrode. Samuel Glasstone. *J. Chem. Soc.* **123**, 2926-34 (1923); cf. *C. A.* **18**, 2997; **19**, 771, 1228.—The difference between overvoltage as detd. by direct and commutator methods is presumably due to (a) induced currents and (b) the "surface resistance" of the metal-gas-electrolyte system at the surface of the electrode. By arranging the circuit so that it is still closed when the polarizing current is off and contains mutual and self inductance, the difference between the potentials at the end of the on-period and the beginning of the off-period of the polarizing current will be the difference due to (b) above. If the circuit contains no inductance and is open when the polarizing current is off, the above difference will be that due to (a) plus (b). For various electrodes the errors as thus detd. due to (a) and (b), resp., were as follows, Pb anode in N NaOH 0.09, 0.13 v.; Pb cathode in N NaOH 0.13, 0.15; Pb anode in N H_2SO_4 0.03, 0.12; Pb cathode in N H_2SO_4 0.12, 0.18. **III. The measurement of overvoltage.** *Ibid.* 250-60.—By variation of the commutator setting and speed the electrode potential had been detd. at 0.002, 0.004, 0.006 and 0.012 sec. after cutting off the polarizing current, by which means the true potential at the beginning of the off-period could be detd. by extrapolation to zero time. This has been done for the 4 electrodes and 2 circuits described in part II above, in each case a small (1.0 sq. cm.) and a large (7.5 sq. cm.) electrode are used, the detns. are made in all cases for 7 c. ds. The over-voltage as thus detd. by extrapolation and that as detd. directly without use of a commutator agree very closely for the small electrodes at low c. ds. (0.008), but differ by 4-15% (the direct method giving higher values) for the same low c. d. but with the large electrodes, while with the small electrodes but at high (0.032) c. d. the similar difference was approx. 10%. Results are also tabulated showing the overvoltage of these 4 electrodes at 10°, 40° and 70° as detd. directly and by the above extrapolation method. The divergence between the results of the direct and extrapolation methods at high c. ds. and the effect of temp. and electrolyte concn. on this divergence indicate that it is due to the surface resistance of the electrode.

WM. B. PLUMMER

The potentials of metals against pure water. A. Smits, H. Gerding and Miss R. Kreeon. *Rec. trav. chim.* **44**, 638-42 (1925) (in English).—From an expression previously derived (Smits and Aten, *C. A.* **11**, 904) for the dissolution of a metal in H_2O or acids it appears that as a limiting case all metals must be sol. in absolutely pure H_2O although to a remarkably small degree. The theoretical basis of this statement is fully given. It was decided to det. whether the potential of noble metals in pure H_2O do indeed become equal to the H potential. The app. used was that devised by C. A. Lohry de Bréyn (*C. A.* **15**, 2032). The data given show that with Ag and Cu electrodes with H_2 at 1 atm. the potential, which is established very slowly (14 and 10 days, resp.), in pure H_2O comes to within 0.005 v. of that of a H electrode, which proves the above proposition. It was also observed that the Ag potential in pure H_2O is fairly strongly dependent on the illumination. Moderate artificial illumination changed the potential from 0.412-0.420 v. after standing overnight in the dark, to 0.435-0.447 v. in 3 expts. A few hrs. illumination made this electrode 0.150 v. more negative, but did not affect a Cu

electrode. The Ag electrode potential is also made somewhat more negative by raising the temp. but returns to its former value if the temp. is lowered for a day. E. J. W.

The electromotive behavior of aluminium. II. A. SMITS AND H. GERDING. *Z. Elektrochem.* 31, 304-8(1925); cf. *C. A.* 19, 2302.—On measuring with a ballistic method the potential of Al-Hg mixts. of varying compn. in a satd. soln. of the Al salt of acetylacetone (in this soln. the Al is only slightly attacked), it was found that up to 0.35 at. % of Hg in the mixt. the negative potential decreased rapidly. From there on the potential rises up to the point where the 2-phase equil. liquid + solid amalgam with const. potential began to appear (-1.390 v.; 0.78 at. % Hg). It appears from these facts that the e. m. f.- x curve of the Al-Hg system is such that the potential (extrapolated) of pure Al lies some 0.130 v. below that of the 2-phase equil.; the condition of pure Al in inner equil. with a soln. can, however, never be reached; only on addn. of Hg is the establishment of this equil. more and more accelerated and thus the "catalytic" rapid decrease of potential in the region below 0.35 at. % Hg is caused; beyond this percentage the mixt. behaves normally. Assuming the value -1.30 v. (Müller and Holz, *C. A.* 16, 3580) for the normal potential of the 2-phase amalgam with respect to the normal H electrode (this value is probably a little too positive) it follows that the potential of pure Al in inner equil. with a normal Al ion soln. is -1.43 v. Thus to Al a place between Mg and Mn in the potential series must be assigned. B. J. C. VAN DER HOEVEN

The passage of an alternating current through sulfuric acid. R. T. LATTEY. *Phil. Mag.* 50, 444-53(1925).—The relationships between capacity (C), resistance (S), current strength and periodicity (p) during the passage of a. c. through H_2SO_4 soln. have been investigated for values of p between 25 and 500 for 4 pairs of Pt electrodes. The law connecting capacity and periodicity seems to be $pC = A + pB$, and that connecting resistance with periodicity $pS = D$, where A , B and D are consts. depending on the nature and condition of the electrode surfaces. S. C. LIND

Determination of chemical equilibrium between different oxidation stages by electromotive force measurements. II. Equilibria between bivalent, trivalent, quadrivalent, and septavalent manganese in phosphoric acid solutions. G. GRUBE AND M. STRAESCHKE. *Z. Elektrochem.* 31, 362-71(1925); cf. *C. A.* 17, 1577.—Measurements have been made at 12° in a 37.8 N H_3PO_4 soln. contg. 0.02 g.-atom of Mn of the potential of the several oxidation stages for ratio from 1:9 to 9:1. For the ratio 1:1, the potential $E(Mn^{II} \rightarrow Mn^{III}) = +1.221$ v., $E(Mn^{III} \rightarrow Mn^{IV}) = 1.526$ v.; with 0.01 g. atom Mn in 40.5 and 25.0 N H_3PO_4 , resp., $E(Mn^{IV} \rightarrow Mn^{VII}) = +1.639$ and $+1.567$ v. E varies widely with both Mn and acid concns. The decomposition of $MnPO_4$ according to $2Mn^{III} \rightleftharpoons Mn^{II} + Mn^{IV}$ shows a min. in 30 to 35 N acid. For $Mn_3(PO_4)_4$: $4Mn^{IV} \rightleftharpoons 3Mn^{III} + Mn^{VII}$ goes to the right with decreasing acid concn. Contrary to what is expected from the theory, $Mn_3(PO_4)_4$ under suitable conditions is a better oxidizing agent than $HMnO_4$ and a better reducing agent than $MnPO_4$. GEORGE CALINGAERT

A method for obtaining directly the second derivative of a current-voltage characteristic curve. A. E. RUARK. *Science* 62, 182-3(1925). G. L. CLARK

Dielectric experiments on the molecular condition of dissolved substances. L. EBERT. *Naturwissenschaften* 13, 681-2(1925).—According to Walden (*C. A.* 7, 2505) low dielec. consts. of solvents are increased considerably on dissolving a real salt in them; this effect is now used as a criterion for the mol. structure of the solute. In a soln. of HCl in benzene the elec. moment of HCl is within the limits of error as low as that of gaseous HCl. However, on addn. of C_2H_5OH in small quantities the polarizability of each of the solutes was raised considerably; it was proportional to that part of either HCl or C_2H_5OH that could be expected from mass law relations to be present in the salt form of $(C_2H_5OH_2^+)Cl^-$. In pure benzene 0.095 M HCl gives an increase of the dielec. const. of 0.6% , on addn. of 2.0 M alc. 16% . The latter soln. is noticeably conductive. Other similar cases are discussed. B. J. C. VAN DER HOEVEN

The dielectric constants of ethane, ethylene, acetylene and butylene, and the symmetry of unsaturated bonds. C. P. SMYTH AND C. T. ZAHN. *J. Am. Chem. Soc.* 47, 2501-7(1925).—By a method described previously (*C. A.* 19, 426), S. and Z. have measured the dielec. consts. of C_2H_6 , C_2H_4 , C_2H_2 and α -butylene and found them to be in accord with Debye's theory of dielectrics as applied to gases. The mol. of α -butylene only was found to have an elec. moment and that was small. The electronic structure of an unsatd. bond is sym., but the field around it is stronger than that around a satd. bond, so that if the unsatd. bond is unsymmetrically located in the mol. the induced electronic shifts will give a moment to the mol. as a whole. E. R. SCHIERZ

Dependence of dielectric constants of aqueous solutions on temperature. L. L. KOCKEL. *Ann. Physik* 77, 417-48(1925).—The dielec. consts. of org. solvents have

been measured with great precision, but slight attention has been accorded H_2O and aq. solns. A new app., based on a modification of Giebe's bridge method (*Z. Instrumentkunde* 31, 6) has been constructed, permitting measurements of very low cond. Data are given for the temp. dependence of the dielec. const. of pure H_2O between 0° and 100° , urea, and cane sugar solns. Water exhibits a linear decrease of the const. with increasing temp., but the cane sugar solns. show a max. followed by a sharp fall. Temp. coeffs. of cond. are manifestly appreciable in work of this type, and always must be considered in estg. the influence of cond. on the dielec. const. The various phenomena are interpreted in the light of the theories of Debye (*C. A.* 6, 1087), Gans (*C. A.* 15, 2581) and Isnardi (*C. A.* 16, 2063).
H. R. MOORE

Reflection of light by metals, I and II. INGO EBELING. *Z. Physik* 32, 489-501 (1925).—The variation with temp. of the power of reflection of Ag and Cu is detd. and illustrated by photograms obtained with light of limited wave length. The existence is suggested of a relation between the optical properties of metals in the colloidal and solid state, and in the solid and gaseous state.
PER K. FRÖLICH

The depolarization of light by optically inhomogeneous media. I. POKROWSKI. *Z. Physik* 32, 713-20 (1925).—Depolarization of linearly polarized light by an optically inhomogeneous system occurs in such a way that only the light hitting upon the scattering substance suffers depolarization, while the light waves passing through the voids between the suspended matter remain polarized. The relation between the relative quantity of polarized light in the outgoing rays, the thickness of the medium, the concn. of the suspensoid and the size of the suspended particles can be derived mathematically and verified by expts. Based upon these calcns an empirical formula is deduced for the changes with time in the depolarizing properties of a V_2O_5 suspension.
PER K. FRÖLICH

Light scattering in salt solutions. C. W. SWEITZER. *Trans. Roy. Soc. Canada* [iii], 18, III, 125-6 (1924).—Solns. of NaCl, NH_4Cl and Na sulfate have been rendered dust-free by the method of envelopment using Al and Cd hydroxides as ppts. The observed light scatterings in the solns. are much smaller than those calcd. by the Smolouchowski-Einstein-Cabannes formula.
B. C. A.

Determination of angle of rotation of sugar solution. P. HANCK. *Z. physik chem. Unterricht* 38, 85-6 (1925).—Rays from a projection lamp pass through a biconcave lens, Nicol prism, calcite prism in a frame with a round screen, and an objective. A wire is attached in front of the screen of the calcite and perpendicular to the main plane of the calcite through its mid-point. Wire and screen are projected through the objective on to a pane of optical glass so that only the image formed by the plane polarized light appears and so that image of wire and zero line on pane of glass coincide. The sugar soln., placed between the Nicol and calcite prisms, causes formation of a second image which is made to disappear by turning the calcite. This turns the wire and its image on the screen with it and thus indicates degree of rotation.
M. BEBER

Mutarotation. VI. The solution volumes and refraction constants of some polyhydric alcohols. C. N. RIEBER, TH. SORENSSEN AND K. THORKELSEN. *Ber.* 58B, 964-70 (1925); cf. *C. A.* 19, 3256.—Three hexitols, sorbitol, dulcitol and mannitol, and also inactive erythritol, glycerol, and ethylene glycol were studied under corresponding conditions. Soln. vols. at infinite dilm. were compared with Traube's values. The 3 hexitols showed significant variations due to structure. The soln. vols. of α - and β -glucose and β -fructose disproved a true carbonyl structure. Mol. refractivities of the 3 hexitols were identical.
A. W. FRANCIS

Calculation of the rotatory power of a tetrahedral molecule. R. DE MALLEMANN. *Compt. rend.* 181, 298-300 (1925).—By making certain assumptions as to the shape of the tetrahedron involved, a complex formula has been derived for rotatory power in terms of atomic refractivities, and the edges of the tetrahedron.
A. W. FRANCIS

A study of the birefringence and the staining properties of agar-agar and of gelatin. JOHN FIELT, 2ND AND C. L. ALSBERG. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xlii-xliii (1925).—As with agar-agar, gelatin dried in the gel form is strongly birefringent whereas, when dried in the sol form, it is not birefringent at all except somewhat at the periphery or at the edges of a crack. In neither case is the birefringence due to the production of strain by adhesion to the support during drying and shrinking, for preps. dried on oiled glass or paraffin blocks do not adhere to them yet show the same phenomenon. Dried agar gels were quickly and deeply stained by EtOH solns. of many of the dyes used in cytological work, whereas the dried sols. stained but slowly if at all.
I. GREENWALD

Reactions of hydrogen activated by excited mercury atoms. H. S. TAYLOR AND A. L. MARSHALL. *J. Phys. Chem.* 29, 1140-7 (1925); cf. *C. A.* 17, 489; 18, 942, 3532;

19, 915, 1663; A. L. MARSHALL. *J. Phys. Chem.* 29, 842(1925).—The reactivity of at. H, produced by the action of activated Hg ats. on H₂ at atm. pressure, is studied for the reductions of C₂H₄, O₂, CO, CO₂, N₂ and N₂O. Activation of H₂ alone is necessary for the reduction of C₂H₄, CO and O₂, no activation of the compd. reduced being necessary. The reaction between H and CO yields HCHO, *inter alia*. The velocities of reaction, as measured by pressure decrease, are 30, 70 and 25 mm./hr., resp., as compared with 0.05 mm./hr. in the expts. of Cario and Franck. These high yields may result from a chain mechanism of the type obtaining in the photochem. HCl combination. The reduction of CO₂ does not occur under the given exptl. conditions. D. S. V.

Principle of selection and needle radiation. ERNA WEBER. *Z. Physik* 32, 370–83(1925).—Rubinovicz' principle of selection (*C. A.* 13, 1415) is tested for the case that the radiation emitted from the electrons of an at. system takes place as Oseen's needle radiation (*C. A.* 18, 1777). The calcs. show that the principle is valid for an atom not acted upon by any forces, while it fails to work when an external elec. field exists. The existence of a non radiating field of vibration obeying Maxwell's equation is ascertained. PER K. FRÖLICH

Quantum problems of chemical reactions. J. FRANCK. *Z. Elektrochem.* 31, 350–9(1925).—An address. The rotational energy of a mol. is often greater than the heat of dissociation. F. R. BICHOWSKY

Recent progress in the determination of particle size. J. PARRISH. *Oil and Colour Chemists' Assoc.* 8, 195–201(1925).—A brief survey of recently developed methods for detg. particle size, and of some industrial applications of elutriation methods; references. F. A. WERTZ

The compressibility of several artificial and natural glasses. P. W. BRIDGMAN. *Am. J. Sci.* 10, 359–67(1925).—Compressibility tests were made by previously described methods on quartz glass prepd. by Berry of the Gen. Elec. Co., Lynn, Mass., 4 artificial glasses from the Corning Glass Works and 4 natural glasses from volcanic regions. It was proved that compressibility may increase with increasing pressure, and in the substances tested the increase has some intimate connection with the SiO₂ content. This abnormal increase of compressibility with pressure is by far the greatest in pure silica glass, is somewhat less than half as great in pyrex, is still present in the results at 30° for the other two glasses contg. silica, but disappears entirely and is replaced by the normal decrease of compressibility with rising pressure in the one artificial glass free from silica. This abnormal behavior of compressibility is a low-temp. effect (below 75°). Abnormal variation of compressibility with pressure is associated in some way with the glassy as opposed to the cryst. condition. L. W. RIGGS

The technical interpretation of sedimentation curves. FELIX HEBLER. *Farben-Ztg.* 30, 2732–4(1925).—The modified *floculation meter* of Ostwald and von Hahn (*C. A.* 17, 246) and its operation are described. Typical sedimentation curves and photomicrographs of two samples of barytes are used to develop the relation between the number of particles of various sizes to their percentage by wt. in accordance with Stokes' law. F. A. WERTZ

Ozone formation in glowing capillaries. E. H. RIESENFELD. *Z. Elektrochem.* 31, 435–40(1925).—The formation of O₃ by passing air and com. and pure O₂ through heated quartz capillaries was studied, and the effect of temp., velocity of gas flow and moisture on the yield of ozone detd. The formation of O₃ in quantities greater than that demanded on the basis of simple kinetic considerations is explained as due to an adsorbed layer existing on the capillary wall in a concn. higher than that of the free gas itself. ARTHUR GROLLMAN

Periodic system and electron-isomeric elements (SWINNE) 3. Dependence of reciprocal precipitation of gelatin and colloidal Cr₂O₃ hydrosols on the equivalent aggregation of Cr₂O₃ micelle (WINTGEN, LÖWENTHAL) 29. Crystal structure of some metallic sulfides (RAMSDALL) 8.

MCPHERSON, WM. and HENDERSON, WM. E.: **Exercises in Chemistry.** Systematically arranged to accompany "An Elementary Study of Chemistry." Boston and New York: Ginn & Co. 141 pp.

3—SUBATOMIC PHENOMENA AND RADIOCHEMISTRY

S. C. LIND

Photoresistance effect for metals at low temperatures. R. S. BARTLETT. *Phys. Rev.* **26**, 247-55(1925). D. C. BARDWELL

A theory of electrical conduction in metals. A. WOLF. *Phys. Rev.* **26**, 256-60 (1925). D. C. BARDWELL

A relation between the critical potentials and the indexes of refraction of elements and compounds. B. DAVIS. *Phys. Rev.* **26**, 232-40(1925). D. C. BARDWELL

Electron and quantum from the experimental standpoint. R. A. MILLIKAN. *Z. physik. Chem.* **116**, 65-80(1925).—Nobel address, delivered May 23, 1924.

The statistical distribution function in radiation and specific heat theory. E. CSASZAR. *Z. Physik* **32**, 872-80(1925).—Polemic; cf. Schrödinger, *C. A.* **18**, 3004. NORRIS F. HALL
F. R. BICHOWSKY

The thermal equilibrium between quantized atoms and blackbody radiation. P. JORDAN. *Z. Physik* **33**, 619-55(1925).—The statistical principle of Bose (*C. A.* **19**, 6) allows a simple proof of the Planck distribution equation. F. R. B

The collisions between light quanta. K. SCHAPOSCHNIKOW. *Z. Physik* **33**, 706-9(1925).—The collisions between light quanta are supposed to be elastic. This assumption is consistent with the Planck distribution law. F. R. BICHOWSKY

β -Ray spectra of thorium disintegration products. D. H. BLACK. *Proc. Roy. Soc. (London)* **109A**, 166-76(1925); cf. *C. A.* **19**, 438.—The increasing importance of β ray spectra in problems relating to atomic structure makes it desirable that accurate analysis be made for as many substances as possible which emit β rays. Improved data are obtained for Th B, Th C + D and for Ra D, the analysis being made by sepg. the β -rays into a spectrum by a magnetic field, using the focusing method. Intensities and energies are given for 17 lines in the Th B spectrum, 40 lines in the Th C + D spectrum, and 4 lines in the Ra D spectrum. Attempts are made to classify the lines into groups corresponding to the ejection of electrons from the various absorption levels by γ -rays. The results of this investigation give further strong support to the now generally accepted hypothesis that the lines of β ray spectra are due to the conversion of γ -rays in the various K and L levels of the atoms concerned. One of the outstanding problems in the interpretation of these spectra is to det. whether the γ -ray is converted before or after the nuclear change takes place. There appears to be some slight evidence that the conversion of the γ -ray takes place after the nuclear change. W. F. MEGGERS

The formation of alpha-ray tracks by simple means. CHAS. T. KNIPP AND N. E. SOWERS. *J. Optical Soc. Am.* **11**, 191-3(1925); *Proc. Indiana Acad. Sci.* **34**, 217-9. D. E. SHARP

The passage of slow canal rays through hydrogen. A. J. DEMPSTER. *Proc. Nat. Acad. Sci.* **11**, 552-4(1925). Positively charged hydrogen atoms are accelerated through 900 volts and enter a vessel which is evacuated, or filled with H at various pressures. In the passage through the vessel they are bent by a magnetic field on to a second slit and the rays passing through this second slit are measured electrically. In the presence of hydrogen the canal rays should require a different accelerating voltage than that necessary in a vacuum (with const. magnetic field) to bring them through the second slit, because of loss of charge by picking up electrons from the H molecules through which they pass. Any loss of velocity of the canal rays as they pass through the H mols. should also affect the necessary accelerating voltage. No such effect was observed between H pressures of 0.008 and 0.00017 mm. of Hg; therefore it may be concluded from mean-free-path calcs. that: (1) Protons with a velocity of 4.16×10^7 cm./sec. (900 v.), will pass through many hydrogen molecules without being neutralized. (2) Their velocity is not altered by as much as 2 v. in passing through the mols.

The electric charge carried by thorium X and thorium emanation recoil atoms in gases. G. H. BRIGGS. *Phil. Mag.* **50**, 600-12(1925). The recoil atoms from Th X and Th Em have been examd. with respect to their charges at the end of their paths in a number of gases, including He, O₂, H₂, N₂, air, N₂O, C₂H₆, NH₃, etc. The results are practically identical in all the different gases, namely 100% of the Th X, 0% of Th Em recoil atom having + charge at the end of their paths. By including previous result for Th A and Th B the following series can be set up: Th X (100%), Th B, Th A, Th Em (0%). The corresponding nos. of electrons in the outer shell are 2, 4, 6 and 8.

showing a relation to the electron affinities that would be expected from the general relation of at. structure and ionization. S. C. LIND

The heating effect of the γ -rays of radium B and radium C. C. D. ELLIS AND W. A. WOOSTER. *Phil. Mag.* 50, 521-36(1925); cf. *C. A.* 19, 1813.—A new type of differential calorimeter is used. The problem of disposing of the heat of the α - and β -rays is solved by placing the source (Rn in a glass tube) in the hollow axis of a Cu rod of 8 mm. diam. and 3 mm. bore. The γ -radiation emerging then passes across an annular space of 3 mm. clearance into the calorimeter proper. The calorimeter consists of 4 segments of 90° each, 16 cm. in radius and 3 cm. high. Two opposite segments are of Balsa wood for elec. and heat insulation. The other alternate two, of Pb and Al, resp., are sepd. by the wood. The Al segment is bored out so as to have the same heat capacity as the Pb segment. The temp. difference between the Pb and Al is detd. by 19 Ag constantan thermocouples in series, which are placed through the center of the segments by having them made in two concentric parts. Thus the heat radiated from the Cu (due to α - and β -radiation), which is larger than the heat from the γ -rays, cancels out and only the differential effect due to the greater absorption of γ -rays in Pb is registered on the galvanometer. This elegant method affords much greater accuracy than the older difference methods. The total heat effect of the γ -rays of Ra B and Ra C in equil. with 1 g. of Ra is 8.6 cal. per hr. of which 0.86 cal. is due to Ra B and 7.7 cal. to Ra C. These data will be utilized in detg. the abs. intensities of γ -rays in connection with the theory of the structure and properties of the at. nucleus. S. C. LIND

Radioactivity. Report of Committee on X-rays and Radioactivity. A. F. KOVARIK AND L. W. MCKEEHAN. *Bull. Nat. Res. Council* 10, Pt. I, No. 51, 171 pp.—A complete review of the field from 1916 to June 30, 1924. Authoritative and thorough. A new nomenclature is proposed. Full bibliography. NORRIS F. HALL

Fused silica in radium production. C. H. VIOL. *Chem. Met. Eng.* 28, 692(1923).—Fused silica was proved satisfactory for the large-scale evapns. and crystns. involved in the production of Ra salts. WM. B. PLUMMER

A mathematical statistical investigation concerning subelectrons. HERBERT DAECKE. *Phil. Mag.* 50, 637-44(1925); cf. *C. A.* 19, 1529.—The question as to the existence of subelectrons is considered using observations of König and of Radel on Hg droplets in CO₂ and in air. No definite conclusion is reached. If the observations of shortages of the elementary quantum of electricity are to be reconciled with the proof for the existence of such a quantum, then it must be possible in some manner to refer these shortages to 4.77×10^{-10} E. S. U. The fact that the apparently irregular shortages stand in a definite relationship to 4.77×10^{-10} E. S. U. can perhaps be useful in this connection. Another conclusion, however, appears to be at least equally probable: namely, that for small radii a division of the electron actually occurs and in n parts. Of these n parts, m_i ($< n$) can occur as united. S. C. LIND

Note on Saha's ionization formula, and on the theoretical value of the photoelectric absorption coefficient. E. A. MILNE. *Phil. Mag.* 50, 547-50(1925).—Saha's formula for high-temp. ionization requires a factor (partition function) relating to the *a priori* wts. of the stationary states of the ionized atom, as well as the factor relating to those of the neutral atom introduced by Fowler. The formula for the photoelec. absorption coeff. requires similarly a factor for the wt. of the lowest state of the ionized atom, as well as the factor for the wt. of the neutral atom given by Kramers, Becker, and the writer. In all cases a ratio of wts. is necessarily involved. S. C. LIND

The motions of electrons in oxygen. H. L. BROSE. *Phil. Mag.* 50, 536-46(1925).—Previous expts. (Townsend and Bailey, *C. A.* 16, 681) indicated a different behavior of electrons moving in an elec. field in O₂ from that exhibited in N₂ and H₂. A more detailed study is now made replacing the photoelec. effect as a source of electrons by use of a hot filament. Great pains have been taken to insure purity of the O₂ both initially and during the expt. The dependence of the velocity of the electrons on gas pressure is thereby eliminated and the conclusion is drawn that the previous observations on electrons in O₂ were affected by gaseous impurities probably arising from the ebonite insulation. Earlier attempts to formulate a theory for the observed increase of the mean free path of electrons in O₂ with diminution of velocity are critically reviewed and found unsatisfactory. S. C. LIND

The relative ionization in different gases for slowly moving electrons. W. P. HESSE. *Phys. Rev.* 26, 298-30(1925); cf. *C. A.* 19, 1990.—A uniform beam of electrons was obtained by allowing thermions from a W filament to fall through a p. d. and pass into a short region devoid of strong elec. field, where as a result of the energy acquired they ionize the gas present. Ionization was detd. for electrons from 20 to 300 v. For

200 v., the relative ionizations at 1 mm. pressure with reference to Ne as 1.0 are: H₂, 0.91; He, 0.48; CH₄, 3.5; N₂, 3.2; CO, 3.45; A, 4.1. D. C. BARDWELL

The apparent transmission of low-velocity electrons through aluminium foil. H. E. HARTIG. *Phys. Rev.* 26, 221-31 (1925).—Al shows a transparent at. effect for slow electrons similar to that observed in rare gases, the max. transparency being for 2 v. electrons. D. C. BARDWELL

Passage of electrons through photosensitive crystals. HERBERT LENZ. *Ann. Physik* 77, 449-76 (1925).—Many insulating crystals, such as zinc blende, diamond, etc., conduct current when strongly illuminated. Gudden and Pohl in recent years have shown that this current is due partly to electronic and partly to electrolytic conduction; the latter phenomenon is observed in the dark under the influence of a sufficiently high elec. field (about 8000 v./cm. in ZnS). The electronic current is negligibly small in the dark, but in the presence of light, it is proportional to the intensity of light and the strength of the applied elec. field. The 2 phenomena can thus be studied separately. If a magnetic field is applied in a direction perpendicular to the elec. field, the electron stream is deflected, and a true Hall effect is produced. The presence of the Hall effect is a criterion, therefore, for the electronic nature of the photocurrent. Owing to the regular arrangement of atoms in crystals, the Hall effect is regular and symmetrical, in distinction from that obtained with ordinary conductors. Expts. with diamond and ZnS crystals show that the Hall effect voltage is directly proportional to the magnetic intensity when the elec. field strength is const.; on the other hand, when the magnetic intensity is const., the Hall effect voltage is proportional to the elec. field strength up to a certain value of the latter, beyond which it becomes const. At const. elec. and magnetic intensities the Hall effect voltage reaches a satn. value as a function of the electronic current. On the basis of the usual electromagnetic equations, L. calcs. from the exptl. data that for diamond the time of free travel of an electron is 10^{-12} sec., its mean free path 3.4×10^{-6} cm., and the velocity 6.8×10^8 cm./sec. Similar values are obtained for electrons in ZnS. L. concludes from this that the electrons move freely on the av. through the distance of 100 atoms, so that the motion of the electron is neither from atom to atom, nor directly to the anode. When a portion of the crystal is shielded from the light perpendicularly to the direction of current, the current through the crystal falls to a few % of the value when fully lighted. The amt. of diffuse light in the shielded part of the crystal is not sufficient to account for the magnitude of the current, which therefore must be due to the passage of the electrons liberated in the lighted part of the crystal through the dark part. Some crystals show an anomalous Hall effect; e. g., in ZnS the effect is not reversed immediately after reversal of the magnetic field, but assumes the normal direction only after a lapse of a certain time. Changing the relative positions of the symmetry axes of the crystal with respect to the direction of the applied elec. field, and shielding portions of the crystal longitudinally brought out no regularities. Diamond, which ordinarily exhibits a normal Hall effect, yields an anomalous effect when thus shielded. If the effect of the light is to force valency electrons to higher quantum orbits, the magnetic properties of a lighted crystal should differ slightly from those of a crystal in the dark. Expts. show, however, that the diamagnetism of diamond is not altered enough for the change to become evident with the most sensitive arrangement L. was able to devise. Bombarding the crystals with high speed electrons produces effects analogous to those of light, at least qualitatively. Measurements of the temp. coeff. of the photocurrent show that in case of diamond, the current is const. at very low temp.; above about 135° K. it increases linearly with temp. In case of ZnS the current vanishes below 125-45° K.; above this temp. it rises, first slowly, then more rapidly; the relation between the current and temp. is given by 2 straight lines meeting at an angle, the break being at about 250° K.

F. C. KRACEK

Periodic system and electron-isomeric elements. RICHARD SWINNE. *Z. Elektrochem.* 31, 417-23 (1925).—A discussion of the periodic table from the standpoint of the electronic considerations of Bohr, Stoner and Sommerfeld. The view of an isomerism brought about by electronic rearrangement is suggested. *Passivity, magnetism, catalysis* and other phenomena are discussed as manifestations of such an isomerism.

ARTHUR GROLLMAN

A new source of positive ions. C. H. KUNSMAN. *Science* 62, 269-70 (1925).—A previously well fused mixt. of iron oxide and about 1% of an oxide of an alkali or alk. earth metal, after partial reduction, glowing and degassing, gave steady positive ion currents in a vacuum of 10^{-6} mm. of Hg. The current obeyed Richardson's temp. law, and was sometimes as large as 10^{-4} amperes per cm.²

NORRIS F. HALL

Kinetic theory of the thermionic effect. N. P. RASHEVSKY. *Phys. Rev.* 26,

241-6(1925).—For various assumptions as to the behavior of electrons inside a solid body, statistical deductions are made for the thermionic current. The formulas are all of the type $i = AT^a e^{-b/T}$, differing only in the values of A and a , which cannot be decided upon with present data. D. C. BARDWELL

Ionization of mercury vapor by ultra-violet light. G. F. ROUSE AND G. W. GIDDINGS. *Proc. Nat. Acad. Sci.* 11, 514-7(1925).—To distinguish between a true ionization of Hg vapor and a photoelec. effect at the electrodes by light from a quartz Hg lamp, Steubing's work (cf. *C. A.* 4, 539) was repeated. Conclusions: A hot Hg arc produces a photoelec. effect but does not ionize Hg vapor. A water-cooled arc produces in addn. to the photoelec. effect an ionization of the vapor for pressures of 10 mm. The light of 2536 Å.U. must ionize by a cumulative effect as it has not sufficient energy to produce ionization of itself. It was found that the action is not due to a combination of the energies of the 2536 line with that of a single electron impact nor the energy of a line in the $2p_2$ series, nor to the emission of electrons at the electrode by excited atoms. The possibility of the collision of 2 excited atoms so as to give the energy of both to one with subsequent absorption of 0.6 v. energy from thermal impacts is to be investigated. D. S. VILLARS

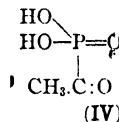
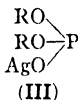
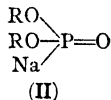
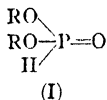
Ionization produced in gaseous reactions. A. KEITH BREWER. *Proc. Nat. Acad. Sci.* 11, 512-4(1925); cf. *C. A.* 17, 3458; 18, 2104.—When EtOH and O_2 react between Au electrodes at temps. below ignition, (1) the current between the electrodes is proportional to the voltage (—2400 to +2400 v./cm.); (2) change in sign of p. d. merely changes the direction of the current; and (3) the current increases 40% for each 10° rise in temp. When Al electrodes are used the current is barely detectable (the app. was sensitive to 10^{-16} amps.). Cu electrodes give a current larger than the Au when the hot outer electrode is negative, but almost none when it is positive. Glass electrodes give a slightly larger current when the outer electrode is negative, than that when it is positive. *Conclusion.*—Ions are formed at the layer of gas on the electrode and not between the electrodes. B. supposes a polar mol. coming within 10^{-6} cm. of a conductor is attracted with increasing force to the surface by its "elec. image" until the attractive force is sufficient to ionize the mol. D. S. VILLARS

Photographic investigation of scattered X-radiation. P. A. ROSS. *J. Optical Soc. Am.* 11, 217-20(1925).—The spectrograms previously described (*C. A.* 18, 3538) are reproduced. F. O. ANDEREGG

X-rays scattered by molybdenum. P. A. ROSS. *Proc. Nat. Acad. Sci.* 11, 567-9(1925).—The spectrum of the rays scattered from the Mo cathode shield in X-ray tubes with W and Mo targets has been studied. From the tube with the tungsten target the scattered spectrum shows the usual modified and unmodified lines of the Compton effect. The ratio of the intensity of the unmodified to the modified line is about 9 to 1. This ratio may be influenced by a tungsten film from the target deposited on the cathode cup. In the case of the molybdenum target the intense fluorescence of the cathode shield obscured the position of the unmodified line; the modified line was, however, present. S. K. ALLISON

The relation between chemical constitution and Röntgen ray K absorption spectra. II. Investigation of phosphorus compounds. OTTO STELLING. *Z. physik. Chem.* 117, 161-74(1925); cf. *C. A.* 18, 1239.—The effect of different radicals which are bound directly to quinquivalent P on the K absorption wave length, and also the effect of different valences of P with the same radicals, are studied. A shift $\Delta\lambda$ (X units) toward longer wave lengths when different radicals are substituted for O in phosphoric acid was obtained, as follows: (RO) $_3$ PO, standard; (RO) $_2$ HPO, 3.4; (RO)H $_2$ PO, 6.8; (RO) $_2$ (RC)PO, 4.4; (RO)(RC) $_2$ PO, 8.4; (RC) $_3$ PO, 9.7; (RC)POR, 12.3; (RN)Cl $_2$ PO, 8.1; (RN)(RO)ClPO, 5.2; (RN)(RO) $_2$ PO, 0.5; (RN) $_2$ (RO)PO, 3.4; (RN) $_3$ PO, 5.8; (RC) $_3$ PS, 12.5; (RO)(RC)HPO, 7.4; (RO) $_3$ P, 9.2; (RC) $_3$ P, 16.9; (RO)Cl $_2$ P, 9.5; (RC) $_2$ P, CuCl, 13.8; (RO) $_3$ P.CuCl, 8.2. Elements bound directly to P cause a shift of the K absorption limit toward longer wave length in the following order: O < N < H < C (< Cl?). A change of the radical represented by R in the above list does not produce a measurable effect on the absorption limit. In general, when an element which is bound directly to P is displaced by another, the shift of the K absorption limit depends not only upon the nature of the substituent group, but also on the nature of the other groups which are bound to the P. III. A Röntgen ray spectroscopic method for the determination of chemical constitution. *Ibid* 175-93.—A summary of the measurements of S. and of Lindh (*C. A.* 19, 2165) on the K absorption limits of compds. contg. elements of low at. no. With the exception of S, the pure element always has a longer wave-length absorption limit than any of its compds. The wave-length shift per valence unit (one outer electron given up) for the elements Si to Fe, bonded with O, decreases

with increasing at. no. In a series of sulfides, the wave length of the absorption limit increases with increasing interatomic distance (increasing distortion of sulfide ion). **The constitution of phosphorous acid and its derivatives.** *Ibid* 194-208.—S. gives a critical review of previous work. By means of the X-ray spectroscopic method, he finds that the wave-length shift of the K absorption limit for phosphorous acid, its salts and diesters, $(CPh_3)_2HPO_3$, $FePrPO_3$, is the same in the solid state. Therefore, all these substances have the same constitution (I). $NaEt_2PO_3$ has the constitution (II), while $AgEt_2PO_3$ is represented by (III). Monoacetyl phosphorous acid is represented by (IV). In soln., the diesters and metallic esters of phosphorous acid are probably a



tautomeric mixture contg. tervalent and quinquavalent P.

R. J. HAVIGHURST

The non-existence of the Clark-Duane secondary spectrum in faultless crystals. A. P. WEBER. *Z. Physik* **33**, 767-76 (1925).

F. R. BICHOWSKY

Determination of the intensity relations in systems of Debye-Scherrer rings. Application to the study of the photographic process. R. BLUNCK AND P. P. KOCH. *Ann. Physik* **77**, 477-94 (1925).—The authors describe a method of studying the intensity relations of the lines in X-ray powder photographs taken by the method of Debye-Scherrer. The photometric measurements are made by means of a microphotometer designed by Koch (*Ann. Physik* **39**, 709 (1912)). The method is applied to a study of X-ray photographs of Ag produced by development of an exposed AgBr plate.

F. C. KRACEK

Formation of silver in silver halides under intense illumination. P. P. KOCH AND H. VOGLER. *Ann. Physik* **77**, 495-502 (1925); cf. *C. A.* **19**, 2914.—The formation of the latent image in photographic plates has been ascribed to the passage of an electron from the neg. halogen ion to the Ag ion; the neutral halogen atoms then diffusing out leave behind a residue of Ag nuclei which serve as starting points in development of grains. X-ray powder photographs of exposed plates should show lines due to metallic Ag before the latter are developed. Examn. of photographs of AgBr emulsion show, by comparison with photographs of Ag produced by development, that lines due to Ag are present in photographs of the exposed, undeveloped emulsion. Similar results are obtained with AgCl emulsions. AgI yields no Ag lines even after 4 months exposure to sunlight. The exptl. technic was that developed by Blunck and Koch (cf. preceding abstr.).

F. C. KRACEK

The methods of crystal structure analysis with X-rays. H. MARK. *Z. angew. Chem.* **38**, 771-4 (1925).—A general consideration of the exptl. methods of detg. the size of the unit crystallographic cell, the no. of mols. in each cell, the space-group and intensities of reflection. Unsolved problems are (1) methods of prepn. of good single crystals which will permit accurate intensity measurements, and (2) an explanation of how X-ray interference takes place in lattices built up of Bohr atoms.

G. L. C.

Recent researches in positive rays. W. WIEN. *Proc. Phys. Soc. (London)* **37**, 324-33 (1925).—Guthrie lecture reviewing his own work (*C. A.* **16**, 1644; **17**, 2391, 3136; **18**, 938, 1612, 2107, 2835) and his students': Rau (*C. A.* **18**, 1242), Döpel (*C. A.* **19**, 2449) and Krefft (*C. A.* **18**, 3546; **19**, 931).

F. O. ANDEREGG

The formation of active hydrogen in the creepage corona discharge. F. O. ANDEREGG AND H. N. HERR. *J. Am. Chem. Soc.* **47**, 2429-31 (1925).—The presence of glass wool which had been found helpful in promoting oxidation of N (*C. A.* **18**, 1246) also helped to activate H. The tube soon became fatigued. It could be restored to activity by prolonged rest, by blowing in a trace of air between runs or by alternate discharge in N_2 . The addn. of traces of O or N during the run had no effect. Explanations are given for the results obtained.

F. O. ANDEREGG

Experiments with a Crookes tube. A. DAUVILLIER. *Compt. rend.* **181**, 281-3 (1925).—Water-cooled ferrochromium electrodes were sealed directly into a glass tube. A d. c. discharge was allowed to pass through H at 3 pressures. The power input into the tube was const. at 24 w. The cathode w. decreased from 6.7 at 45 bars to 4.9 at 15 bars while the anode w. increased from 1.5 to 8.3. A large part of the loss is due to cathode rays. At 3 kv. 2.5 electrons are liberated at the surface of ferrochromium while at 14 kv. 4 electrons are set free. The proton carries about $1/6$ the current. The rapid disappearance of H was noted and supposed to be due largely to polymerization.

F. O. ANDEREGG

The quantum theory of the Fraunhofer diffraction. P. S. EPSTEIN AND P. EHRENFEST. *Proc. Nat. Acad. Sci.* 10, 133-9 (1924); cf. *C. A.* 17, 3643; 19, 1810.—The question is raised whether it is possible to extend the Duane-Compton theory to the case of finite gratings and of other diffracting structures. This can be done by a procedure similar to Bohr's principle of correspondence, which permits a complete treatment of all the Fraunhofer diffraction phenomena on the basis of the quantum theory with results in all cases identical with those of the classical theory. A similar treatment is given to the phenomena of Fresnel diffraction; here the agreement with classical theory is not quite so complete. It is possible to construct a satisfactory classical analogy to Compton's diffraction even in the case of a change of frequency. GEORGE L. CLARK

Influence of self-inductance and of dilution on the persistence of spectral lines, the ultimate lines, and the quantum theory of optical spectra. A. T. WILLIAMS. *Anales soc. cient. Argentina* 97, 15-53 (1924).—The influence of self-inductance and of dilution on the persistence of lines in the condensed spark spectra of solns of Ca, Ba, Sr, Mg, Zn, Cd, Mn and Cu is compared. The diln. data are taken mostly from Twyman's tables. For Ca, Ba and Sr, weak lines which are unaffected by additional self-inductance appear only when the concn. is $> 1\%$. When self-inductance decreases the intensity of a line to that obtained with a non-condensed spark, the line persists at diln. from 1% to 0 or 0.01%. Strong lines, insensitive to the action of self-inductance, persist in 0.001% soln. and are the typical ultimate lines of Gramont. The relatively intense lines 4872.70 and 4784.51 were observed for Sr, and are not given in Twyman's book. For Mg, Zn and Cd there is practically no parallelism between the effect of self-inductance and of diln. Certain lines insensitive to self-inductance do not persist below concn. of 1.0-0.1%. For Mn those lines markedly decreased by self-inductance disappear at concn. $< 1.0\%$. The quite intense lines 2801.20, 2798.37 and 2794.92, which resist the action of self-inductance, and are not diminished by changing the polarity of the soln., are not mentioned by Twyman. For Cu those lines which disappear by the action of self-inductance usually disappear at concn. $< 1\%$, or 0.1% in a few cases. These lines are absent with the non-condensed spark. On the other hand, lines not affected by self-inductance either disappear for concn. $> 1\%$, or are not mentioned by Hartley. It is emphasized that in order to obtain comparable results, and that spectral analysis may be used as a method of qual. and quant. analysis, it is indispensable to establish a standard for the characteristics of the elec. circuit and for the optical disposition. When the soln. is connected to the positive rather than to the negative pole, many lines weaken or disappear. The typical ultimate lines of Cu, Mg, Ca, Sr and Mn, however, are affected not at all, or only slightly, by a change in the polarity of the soln., but not so those of Ba. The lines 2801.20, 2793.37 and 2794.92 of Mn persist after the polarity is changed, and seem to be ultimate lines, although not so designated previously. Increasing the capacity of the circuit tends to neutralize the effect of changing the polarity of the soln. The series relations of the ultimate lines of the elements of the 1st and 2nd column of the periodic table are tabulated. The typical ultimate lines of the elements of the first column belong to the principal series of doublets whose formula is $ls\text{-}mp$. For the elements of the 2nd column, which possess 3 typical ultimate lines, one of these lines belongs to the principal series of isolated lines whose general formula is $ls\text{-}mP$; and the other 2 to the principal series of doublets of the ionized atom, $ls\text{-}mP$. Exceptions are Zn whose ultimate lines belong to the principal series and the first subordinate series of triplets; and Hg, to the combination series of isolated lines. The theorem of spectroscopic displacement is applicable to the ultimate lines of the alkali and alk. earth metals in the form: The ultimate lines (doublets of the ionized atom) of Mg, Ca, Sr and Ba correspond, resp., to the ultimate lines (doublets of the neutral atom) of Na, K, Rb and Cs. Application of the quantum theory of optical spectra to the study of the ultimate lines shows that the quotients (V_i/V_r) and (V_i/V_e) are const. for the corresponding lines of the similar series in the group Li, Na, K, Rb and Cs; in the sub-group Mg, Zn and Cd; and in the sub-group Ca, Sr and Ba. Also, (V_i/V_r) and (V_i/V_e) decrease when the temp. of the thermal ionization of the element increases. The ultimate lines in the arc and in the spark appear when the atoms are excited to a potential less than the corresponding potential of ionization. The value of the relation is $(V_i/V_r) > 1.4$ (arc), and $(V_i/V_r) > 3.0$ (spark). V_i is the potential necessary to displace completely a 2nd electron after the 1st has been displaced by the potential V_i ; and V_r the potential sufficient to translate interorbitally a 2nd electron after the first has been completely displaced by the potential V_i . The ultimate lines, according to the principles of combination and selection, ought to be those of greater probability. R. H. LOMBARD

The successive stimulation of the arc lines of helium below the ionization potential.

C. B. BAZZONI AND J. T. LAY. *Science* **61**, 518(1925).—By modifying an app. suggested by G. Hertz (*C. A.* **18**, 1786) very steady voltage and current could be obtained. Between the resonance and ionization potentials the arc lines of He could be successively stimulated or extinguished within 0.1 v. of the value calcd. from the accepted term values.

F. O. ANDEREGG

The science of the spark potential and glow discharge phenomena. W. DÄLLENBACH. *Physik. Z.* **26**, 483–95(1925).—An attempt is made to analyze theoretically the complicated problems of the spark potential and the glow discharge. The questions which need to be answered exptly. to confirm his deductions are pointed out.

F. O. ANDEREGG

The starting voltage of the glow discharge and remarks on H. Geffcken's work, "The starting voltage and the stability of the glow discharge." GIORGIO VALLE. *Physik. Z.* **26**, 495–7(1925).—Polemical about high-frequency glow discharges; cf. Geffcken (*Physik. Z.* **26**, 241(1925)).

F. O. ANDEREGG

Photoelectric ionization of cesium vapor. P. D. FOOTE AND F. L. MOHLER. *Phys. Rev.* **26**, 195–207(1925).—By using a small filament cathode practically enclosed by a cylindrical anode in a quartz tube contg. Cs vapor, the change in the ionic current produced by the radiation from a Hg arc was measured as function of applied voltage, filament temp., vapor pressure and wave length. The photoelec. effect increases with increasing wave length to a sharp max. at $\lambda = 3184$ Å. U. of the principal series, then dropping off to 10% at 3400 Å. U. as required by the Bohr theory. The simple theory does not admit of ionization beyond 3184, but the data are in qualitative agreement with the hypothesis that such radiation produces excited atoms, which upon collision with other atoms acquire sufficient energy to become ionized. The tube described may be used as a photo-ionization photometer and intensitometer. D. C. BARDWELL

The effect of chemical constitution on the X-ray spectrum of sulfur. B. RAY. *Phil. Mag.* **50**, 505–11(1925).—The wave lengths of the K lines of S in a great no. of its compds. were examd. Within the limits of exptl. error the wave lengths are the same for S and sulfides on one hand and for sulfates and sulfitates on the other, but a considerable difference exists between the two classes of compds. The lines $K\alpha_1$ and $K\alpha_2$ are shifted to shorter wave lengths in the case of the sulfates and sulfitates while their sepn. is diminished. No such shift was found for $K\alpha_3$ and $K\alpha_4$ lines. The theoretical interpretation is discussed.

S. C. LIND

Experimental determination of the critical excitation frequency for the production of fluorescent X-radiation. S. K. ALLISON AND WM. DUANE. *Proc. Nat. Acad. Sci.* **11**, 485–9(1925); cf. *Phys. Rev.* **25**, 581.—Using an X-ray tube with no bulb, which permits a close approach of the second radiator (Ag) to the target, A and D. prove experimentally that in order to produce a fluorescent line spectrum the primary radiation must contain X-rays of frequency at least as great as that of the corresponding crit. absorption and this frequency is the same for all the lines in the series. D. S. VILLARS

The general nature of band spectra. J. W. NICHOLSON. *Phil. Mag.* **50**, 650–62(1925).—The fundamental relation of line to band spectra based on the assumption that the former are due to monatomic, the latter to polyatomic mols. is discussed.

S. C. LIND

Absorption of light by vapors of lead, tin, bismuth, antimony and magnesium. A. L. NARAYAN AND K. R. RAO. *Phil. Mag.* **50**, 645–6(1925).—Absorption of light by nonluminous vapors of Pb, Sn, Bi, Sb and Mg has been studied, and it has been found that the absorption spectrum of Pb shows, besides the fundamental line λ 2833, a banded spectrum at about 1100°, degraded towards the red and spaced at intervals of 32 Å. U. nearly. Absorption spectrum of Sn showed only a faint reversal of 2706.6. That of Bi showed, besides λ 3067, λ 2524, 2276 and 2230 and 2228, a typical banded spectrum contg. about 20 bands. The absorption at each of these bands is very diffuse and complex, consisting of a no. of finer bands. With increase of vapor density all these bands gradually fuse together (beginning from the short wave-length side) to form a region of continuous absorption. At about 1200° another typical banded spectrum appeared in the visible region extending from λ 6500 to λ 4500. The absorption spectrum of Sb showed fine lines at 2312 and 2306 and a banded spectrum extending from λ 2305 to λ 2250, while at higher temps. there was another banded spectrum in the region 2830–3000 and a fine line at λ 2770. The existence of the banded spectra of these metals of the higher groups of the periodic table leads to the conclusion that the mols. of these elements are polyatomic. 4571, the single-line spectrum of Mg, has been for the first time photographed as an absorption-line by using a long column of the vapor.

S. C. LIND

Ultra-violet absorption as a function of p_H of certain organic acids regarded as

ultra-violet indicators. FRED VLÈS AND MADELEINE GEX. *Compt. rend.* **180**, 1342-5 (1925).—A no. of org. acids have ultra-violet absorption spectra differing from those of their salts. Of these oxalic and benzoic acids were observed during neutralization by NaOH, with the method of VLÈS (*C. A.* **19**, 1549) in which p_H , detd. electrometrically, was plotted against ϕ , the ratio of the absorption consts. of 2 spectral lines which vary dissimilarly during neutralization. In detg. ϕ certain lines between 0.24 and 0.28 microns wave length were selected for observation. The resulting curves are of the "abnormal type" showing maxima and minima. The curves of the monobasic benzoic acid were as complicated as those of the dibasic oxalic acid. C. M. BOUTON

Comments on the work of S. L. Langedijk: I. The absorption spectra of some ketones. I. PLOTNIKOV. *Rec. trav. chim.* **44**, 798-9 (1925).—Toward the end of his paper I. (*C. A.* **19**, 2301; cf. also Cohen, *C. A.* **13**, 2504; **14**, 2785) gives a few results which he concludes are not in harmony with P.'s formulation of the photochemical absorption law. P. states that this law holds only for pure rays in which no thermal or other rays are superposed. P. also makes some interesting comments of a general nature. E. J. WITZEMANN

Ultra-violet spectrophotometry as a method of examining the mechanism of certain chemical reactions, and as a method of qualitative and quantitative determination. HORACIO DAMIANOVICH AND A. T. WILLIAMS. *Anales soc. cient. Argentina* **98**, 241-74 (1924).—The technic is described for detg. the ultra-violet absorption spectra of solns. by the use of the Adam Hilger sector spectrograph with a quartz prism. The data are presented in the form of graphs having $\log(I/I')$ as ordinates and λ as abscissas, I and I' being the intensity of the light before and after passing through the soln., resp. As a test of the method, the change in the structure of the absorption bands which accompanies the decolorizing of fuchsin by SO_2 , and the formation of Schiff's violet by formaldehyde, was detd. One g. nucleic acid dissolved in 20 cc. 5% H_2SO_4 by heating 5 min. at 100° , and diluted 1-50,000 for observation, gave only a slightly higher max. in the absorption curve than did a soln. which had been hydrolyzed 1 hr. 50 min., and 7 hrs. This indicates that the purine and pyrimidine nuclei may be weakly bound, or bound in a way which does not greatly modify the absorption which they produce by sepn. Casein dissolved in 0.03% Na_2CO_3 soln. has a max. and min. in the ultra-violet absorption curve at shorter wave lengths than when dissolved in 0.3% Na_2CO_3 . Also, the max. and min. are modified in a way indicating a change in structure of the casein. Raising the temp. of the casein soln. in 0.3% Na_2CO_3 from 0° to 45° caused a displacement of the curve in the direction of the axis or ordinates; this indicated that the casein was being destroyed giving non-absorbing bodies, which produced the same effect on the absorption spectrum as a diln. of the soln. The study of the absorption curves in the ultra-violet of solns. of definite concn. of uric acid, nucleic acid, and anethole shows that the differences in these curves permit the evaluation of these substances very exactly, and with the use of minute quantities of the substances such as 1-2 cc. of 1-50,000 or 100,000 soln. The curves show that noticeable differences exist when the concn. changes 0.0002%. It is proposed to extend these methods to the study of the compn. of certain liquids of the organism. R. H. LOMBARD

The arc spectrum of nickel. K. BECHERT AND L. A. SOMMER. *Ann. Physik* **77**, 351-71 (1925).—The arc spectrum of Ni is found, in accordance with the alternation law, to have odd multiplicities of energy levels, a singlet, and a triplet system having been established. The spectroscopic term with lowest energy content belongs to the triplet system and has the azimuthal quantum number 4. Overlapping this low triplet F term is a triplet D term; all absorption lines involve these two terms. Typical multiplets of the triplet system and of the singlet combinations as well as intersystem combinations are discussed in detail. All terms are inverted; the magnetic moment of the atom in its normal state is equiv. to 5 Bohr magnetons. Relative term values are given for 63 levels, 9 of which belong to the singlet system; combinations of these account for 354 lines of the arc spectrum of nickel. W. R. MEGGERS

The flame spectra of carbon monoxide and water-gas. I. F. R. WESTON. *Proc. Roy. Soc. (London)* **109A**, 176-86 (1925).—A systematic investigation of the flame spectra of CO, and of mixts. of CO and H_2 was undertaken with a view to the elucidation, if possible, of certain aspects of the combustion of CO. The spectra were photographed with a small quartz spectrograph, three series of expts. being performed. The first series deals with a spectrographic comparison of CO, H_2 , and "water-gas" flames, the second with spectra of CO flames burning in different atms. (ordinary air, argon-air, undried or dried O_2 , etc.), and the third with spectra of CO flames burning in O_2 at different pressures (765 to 61 mm.). A description of the bands in CO flame spectra according to measurements by A. Fowler is given and some regularities are found which

indicate that the bands are in all probability distributed in accordance with the general laws which govern the structure of band spectra. The conclusion is that in the flame of pure (undried) CO, two sets of independent reactions occur simultaneously, viz., (a) direct interactions between CO and O_2 , exciting radiations which give rise to the continuous and banded parts of the spectrum, and to the characteristic blue color of the flame, and (b) interactions between CO and H_2O mols., which originate the "steam-lines" in the spectrum. When H_2 is gradually added to the burning gas, the relative proportions of the first named interactions diminish rather rapidly, and proportionately more of the CO is burned by interaction with H_2O mols., until when an equimolecular mixt. of CO and H_2 is reached, the CO- H_2O interactions occur to the practical exclusion of the CO- O_2 interactions.

W. F. MEGGERS

The measurement of the fine-structure of hydrogen lines with the Lummer-Gehrcke plate. P. H. VON CITPERT *Ann. Physik* **77**, 372-80 (1925).—Theoretical consideration is given to certain corrections which must be applied to the measurement of component sepns. of complex spectral lines observed with the Lummer-Gehrcke interferometer.

W. F. MEGGERS

The absorption spectra of mixed metallic vapors. II. The spectra of volatile compounds of magnesium and the alkali metals. S. BARRATT. *Proc. Roy. Soc. (London)* **109A**, 191-7 (1925).—In a previous communication (*C. A.* **18**, 1433; **19**, 610) a band system was described which was found only in the absorption spectrum of mixed vapors of Na and K. Bands probably analogous in origin have now been found in the absorption spectra of mixts. of the vapors of Mg and alkali metals. The metals were volatilized in a steel tube heated by nichrome wire, difficulty on account of the great interval between the b. p. of Mg and of an alk. metal being overcome sufficiently by making use of the temp. inequalities along the furnace tube and securing suitable mixing by diffusion. The spectra were well developed at temps. of about 1000°. A C arc supplied the continuous background, the absorption spectra were photographed in the visible with a Hilger constant deviation instrument. The Mg-Na spectrum has a single band degraded towards the blue, the wave length of the head being 5290.8 Å U. The Mg-K spectrum is more complex. With dense vapor, 3 bands appear with heads at 6549.7, 5150.4 and 4611.6 Å U. There are absorption bands in the visible due to Rb itself which have not yet been described, but in addition to these another band was observed only in the presence of Mg with its head at 4728.1 Å U. degraded towards the blue. The Mg-Cs spectrum shows two bands, one shaded off on either side of a central max. at 5706 Å U., the other degraded towards the blue from a head at 4839.2 Å U. These spectra are the first indication of chem. combination between Mg and alkali metals. It is impossible to det. the mol. formula of the compds. responsible for the absorption spectra from the expts. here described but an examn. of the structure of the bands under higher dispersion would probably give some indication in this matter.

W. F. MEGGERS

The aurora borealis and the upper layers of the atmosphere. L. VEGARD. *Naturwissenschaften* **13**, 541-50 (1925), cf. *C. A.* **18**, 2287; **19**, 1223.—A review.

B. J. C. VAN DER HOEVEN

Light emitted by solidified gases; the aurora borealis. L. VEGARD, H. KAMERLINGH ONNES and W. H. KESOM. *Verslag. Akad. Wetenschappen Amsterdam* **34**, 331-3 (1925).—Solid N and mixts. of N and Ne were bombarded with rapid cathode rays at the temp. of liquid He. Pure N had a band N_1 of the same structure and place (5555 Å U.) as found in earlier expts. at liquid H temps.; its breadth does not change. Band N_2 was strong but split up in 2 components (5236 and 5222 Å U.). A series of several bands, each consisting of 2 lines with a diffuse edge on the red side, was again found (maxima 5770, 5490, 5116, 4784, 4490, 4223, 3986 Å U.); also some weak lines of long wave length (5914, 5952, 6399 Å U.). N-Ne mixts. at He temps. behaved like N-A mixts. as far as the N_1 band is concerned, i. e., a shift of the primary max to longer wave length and disappearance of secondary maxima. However, for A-N mixts. the change in λ is a gradual one, whereas in Ne-N mixts. (at 4.2° abs.) no shift occurs below 70% Ne. Apparently the sp. influence of A on the spectrum is considerable, that of Ne very small. The shift in the latter case is solely due to a decrease in the size of the N particles. At the limiting concn. for N = 0, band N_1 contracts to a single line at 5578.6 Å U., only 1.2 Å U. apart from the green aurora borealis line. Also in *Proc. Acad. Sci. Amsterdam* **28**, 467-9 (1925).

B. J. C. VAN DER HOEVEN

Influence of absorbed gas on the photoelectric electron emission and the electrical conductivity of platinum. KURT HERRMANN. *Ann. Physik* **77**, 503-36 (1925).—H. finds that the removal of gas from Pt foils by glowing at near the m. p. (1700°) brings about an increase of dec. resistance and a decrease of the photoelec. effect. This agrees

with the results of other investigators, and can be explained by assuming that the number of free electrons in the foil decreases with decreasing gas content. Glowing the foil, in presence of O_2 has little effect on the photoelec. effect, but increases the resistance; in H_2 it brings about an increase of photoelec. current and a decrease of resistance. Results of certain investigators are at fault owing to the degasification having been carried out at too low temps. It seems essential that the glowing out temp. must be near the m. p. of the metal studied in order that the gas be completely removed. Hg vapor also interferes at low temps. Bibliography. F. C. KRACEK

The photochemical formation of hydrogen chloride. G. KORNFIELD AND H. MÜLLER. *Z. physik. Chem.* 117, 242-56(1925).—The reaction was followed by measuring the pressure of H_2 after cooling the reaction mixt. with liquid air. The relation between intensity and reaction velocity was studied in white light, the intensity being varied by metal screens with perforations of different areas placed between 2 diffusing screens; the velocity was proportional to the intensity over a range of 1:64. Abs. detms. of energy relations were made with monochromatic radiation of wave length 436μ ; an av. of 2.5×10^4 m.e.s. reacted per quantum of absorbed energy with a Cl_2 pressure of $1/2$ atm. The max. of 1.1×10^4 was observed only once, and could not be exceeded in spite of elaborate attempts to purify the gases further, by elimination of stopcocks, regeneration of Cl_2 from $AuCl_3$ and continuous flow of gas for months. B. H. CARROLL

Effect of light on the interaction of water and sodium and potassium amalgams. (Preliminary.) S. S. BHATTNAGAR, MATA PRASAD AND D. M. MUKERJI. *Quart. J. Indian Chem. Soc.* 1, 263-72(1925).—Dil. Na and K amalgams react with H_2O in the dark at an appreciable rate which can be detd. by measuring the amt. of H_2 generated. Exposure to light accelerates the reaction. Light from a C arc was used. After passing through the glass and H_2O of the thermostat (kept at 40°) the wave lengths available were λ 3660-5250 A. U. Light intensity was not measured, nor is anything said regarding its constancy. Na amalgams (0.081, 0.158, 0.214 and 0.311 wt. % Na) show a steady increase in the initial reaction rate with concn. of Na in the amalgam in the light over the dark reaction, the difference between the rates approaching something like constancy after the first 30 min. No such regularity is observed with the K amalgams (0.038, 0.041, 0.056 and 0.101 wt. % K), at least during the first hr., for which the expts. are reported. Towards the end of the hr. the difference of the reaction rates, however, does not approach a steady value in the more concd. K amalgams. The authors have apparently not noticed these regularities, and hence have not carried any of the expts. beyond the first hr. The exptl. values are only very roughly quant. F. C. K.

The effect of light on the behavior of selenium contact rectifiers. E. MERRITT. *Proc. Nat. Acad. Sci.* 11, 572-80(1925).—Selenium-metal point contacts show as complete rectification as is exhibited by any of the usual crystal detectors, but the usefulness of such contacts in practical work is hindered by the high resistance and tendency of selenium surfaces to deteriorate with time. Knife-edge contacts of brass, Fe, Al, Zn, Cu, Pb, Au have been used. The effect of the light from a 400-watt gas-filled lamp at a distance of 30 cm. with a water cell interposed was to increase the current if there was a potential of 0.1 volt or more across the contact. For very small e. m. f.'s and low resistance contacts, illumination often resulted in a decrease in the current from the knife edge to the Se, while causing an increase in the current in the other direction. In this case, also, light caused a current to flow from the Se to the knife edge without any applied e. m. f. The study was extended to the rectification of alternating currents by the contact, and the effects were in general those to be expected from the direct-current behavior. S. K. ALLISON

Activation of hydrogen by excited mercury atoms. A. C. G. MITCHELL. *Proc. Nat. Acad. Sci.* 11, 458-63(1925).—The activation of H_2 by excited Hg atoms in the presence of O_2 was measured by condensing the H_2O formed and detg. the pressure of the gases left (cf. C. A. 17, 489; 18, 3532). At const. O_2 pressure (0.036 to 0.04 mm) the rate of activation increases with increasing pressure of H_2 to a satn. value. At const. H_2 pressure the rate increases rapidly from 0 to a max. (at 0.01 mm. O_2) and then decreases to a small but measurable rate. The addn. of relatively large quantities of A stops the reaction completely (cf. Donat, C. A. 19, 780; Stuart, C. A. 19, 2909). M. explains his results by saying that below the optimum pressure of O_2 many H_2 mols. activated by Hg atoms in the $2p_2$ state lose their activation before they have contact with an O_2 mol. Excess O_2 mols. above the optimum concn. kill off the excited Hg atoms, leaving fewer to activate the H_2 and do not gain enough energy to initiate the reaction of themselves. The effect of A is unexplained. D. S. VILLARS

Condensation nuclei produced by the illumination of air-halogen mixtures. I. C. JONES. *Proc. Phys. Soc. (London)* 37, 287-96(1925).—The work of Peajling (C. A. 9,

1579) on air-I mixts. has been confirmed and extended to air-Br and air-Cl mixts. with similar results. The halogens seem to react with a trace of oxidizable matter held on the walls of the coutg. vessel to form a vapor, which on being illuminated a short time reacts with O to form numerous, fairly uniform nuclei in an expansion app. The effect can be prevented by cleaning all surfaces with CrO_3 . It decays with time, more rapidly if illuminated, because the impurity is used up. In the presence of a large surface (glass wool) the nuclei may grow to considerable size. With Cl the decay was very rapid. A coincidence is noted between the conditions giving nuclei in the air-Cl mixts. and those where an induction period is found in the H-Cl reaction. F. O. ANDEREGG

The activating element in luminous boron nitride. ERICH TIEDE AND HENRIETTE TOMASCHEK. *Z. anorg. allgem. Chem.* **147**, 111-22(1925).—The luminescence of this compd. is brought out by ultra-violet light, cathode rays or by contact with a flame. As with the luminous metallic sulfides, such as ZnS , a small quantity of activating material in the form of a heavy metal is necessary, so in this case an activating element must be present. The authors find that C has this effect on BN, only very small quantities being necessary. A cryst. structure is also essential. In prepn. BN, great care is taken to eliminate all impurities, the product shows only faint luminescence, but if only a trace of tartaric acid, urea, sugar, or other org. materials is added, the luminous properties are quite strong. Diamond and graphite are ineffective. The color of the luminescence varies between blue and yellowish green, and shows considerable range in intensity, depending upon the method of prepn. and the type of radiation used in bringing about the luminous effect. A table is given which shows how the effects vary with the methods of prepn., activation, etc. Emission spectra show yellowish green, violet and yellowish red bands, regardless of the method of prepn., etc., but differences in intensity of the individual bands are noticeable. Variation in the method of excitation is discussed. The activating action of C is explained as probably due to its location in the periodic system between B and N. H. STOERTZ

Production of atomic nitrogen and its arc spectrum. K. T. COMPTON. *Phil. Mag.* **50**, 512-6(1925).—C points out the great difficulty of thermally dissociating N_2 into atoms. Eucken (*C. A.* **19**, 2504) has found the heat of dissoc. of N_2 to be 410 kg. cal., corresponding to 19.05 equiv. volts, nearly five times that of H_2 (90 kg. cal.). If this energy could be imparted to N_2 by collision with one excited atom, He appears to be the only one which ought to be effective, having excited states of 19.73 and 20.56 v., either being in excess of the necessary 19.05. The conditions necessary to the dissociation of N_2 are predicted by C. and are found to coincide with those found exptly. by Merton and Pilley (*C. A.* **19**, 1662), though the theory proposed by them was different and appears to be incorrect. The essential conditions are a very small quantity of N_2 in He of about 30 mm. pressure, a high current density, and great purity of the gases. If Ne should also be found effective in causing the dissociation of N_2 , the heat of the latter process could not exceed 370 kg. cal. S. C. LIND

The production of fluorescence and phosphorescence by radiation from the C arc lamp (ANDREWS) 4. Ra, U and V (HESS) 9.

Radium compounds. G. O. WILLIAMS. U. S. 1,554,056 Sept. 15. In pptg. Ra from an alkali-metal carbonate soln., the soln. is acidified with H_2SO_4 , a sol. Ba salt such as BaCl_2 is added, the ppt. is dissolved in concd. H_2SO_4 , and, after filtering, H_2O is added to the soln. until Ra-Ba sulfate is reprecipitated.

Röntgen-ray tube. NAAMLOOZE VENNOOTSCHAP PHILIPS' GLOEI-LAMPENFABRIEKEN. Brit. 231,467, March 27, 1924.

4—ELECTROCHEMISTRY

COLIN G. FINK

Electric melting furnaces. J. A. SEEDE. *Iron & Steel Eng.* **2**, 368-74(1925); cf. *C. A.* **19**, 937.—In a discussion of the improvements made in elec. melting equipment S. compares the elec. capacities of furnaces in 1910 with those in 1925. Increasing the power input to a 5-ton furnace from 700 kw., at 76 v., to 2,000 kv.-amp., with 2-voltage control (150 and 100 v.), made it possible to pour a heat in 3 instead of 5½ to 6 hrs. The power consumption was reduced from 830 to 600 kw.-hr. per ton and the electrode consumption to about half. A discussion of other changes is included under: transformers—3-phase transformers are used instead of 3 single-phase transformers

because they are more efficient, cost less and require less space; *reactance*—either air or Fe core type reactances are used to reduce fluctuations at the start; *electrode control*—electrode speed has been increased from 7 in./min. to 1.5 or 5 times as much; *motor*—types of motors adapted to tilting, and to raising and lowering electrodes are discussed; *furnace construction and practice and induction furnaces*—including details of large melting furnace installations and the possibilities of the Ajax-Northrup principle of heating by induction conclude the report.

A. D. SPILLMAN

Heat balance and efficiency of the electric furnace as compared with other metallurgical apparatus. A. COUTAGNE. *Technique moderne* 17, 545-51 (1925).—Comparison essentially mathematical, of the elec. furnace with the cupola, blast furnace and open-hearth furnace.

A. PAPINEAU-COUTURE

High-frequency induction furnace. D. F. CAMPBELL. *Metal Ind.* (London) 27, 245; *J. Iron & Steel Inst.* (advance proof); *Engineering* 120, 351-2 (1925).—A discussion of the features and application of high-frequency induction furnaces, the Northrup type, and methods of producing the high-frequency current. This furnace has proved successful in the production of Ni and Fe alloys for submarine cable loading. These alloys have increased speed of signalling from 300 to 1800 letters per min. The largest high-frequency installation in England consists of 42 small converters (each 35-40 kv.-amp.), and furnaces that can melt 20 lb. of Ni-Fe alloys in 40-45 min. This type of furnace is adapted to production of W and Co crucible steels and special alloys for the elec. industry. Heat treating and forging offer further possibilities for this principle of heating.

A. D. SPILLMAN

Electric heat-treating applications. E. A. HURME. *Iron & Steel Eng.* 2, 357-68 (1925).—This report covers the principal heat-treating and miscellaneous applications other than melting. It includes a historical sketch of elec. heat and indicates 1.5 million kw. installed in the last 5 yrs. In reviewing the developments in the field of elec. heating the following are included: soaking pits, reheating furnaces, finishing processes, heat-treating furnaces, etc. A discussion of phase changes and factors to be considered in selecting furnaces are also presented.

A. D. SPILLMAN

Possibilities of industrial heating. C. L. IPSSEN. *Iron Age* 116, 74-6 (1925).—The author discusses the application of elec. heat to (1) *steel treating*—here the elimination of annealing boxes reduces the heat absorption by the metal charge and consequently annealing costs are lower for the elec. than the fuel-fired furnace; (2) *copper and brass annealing*—bright annealing of Cu is accomplished by using a water-sealed furnace and a steam atm.; (3) *vitreous enameling*; (4) *japanning* and (5) *core baking* are other applications where a more uniform heat, lower maintenance cost, better working conditions, lower rejections make the "over-all" cost in favor of the elec. furnace.

A. D. SPILLMAN

Heating of ingots by electricity. R. A. BUTLER. *Iron & Steel Eng.* 2, 374-6 (1925).—B. describes an elec. soaking pit. It is a 2-ingot pit having 4 petroleum coke resistors. The pit is practically air-tight and contains a coke braize bottom. *Advantages*.—Ingots show no signs of bending on rolling, rolling is easier, the elec. peak loads on mill drive are reduced 25% below peaks on gas-heated ingots, and the scale loss is $\frac{1}{2}$ that of gas-heated ingots. The power consumption for 2 ingots (3.3 tons each) is 531 kw.-hr., with ideal conditions and hot ingots 100 kw.-hr. With certain suggested changes B. predicts unlimited possibilities for the elec. soaking pit.

A. D. SPILLMAN

Making pure (electrolytic) iron commercially. ANON. *Iron Age* 116, 675-9 (1925).—A description is given of the plant of the Niagara Electrolytic Iron Co. The Fe is produced by the same process as that in use at Grenoble, France. The electrolyte is $\text{FeCl}_2 + \text{FeCl}_3$; anodes are blast-furnace Fe; the concrete cells are impregnated with S so as to render concrete impermeable to electrolyte. Changes over the French process include: larger steel mandrel; the use of grease, instead of Pb, as sepg. film between mandrel and deposit; and greater production (7 instead of 4 tons per day). The deposit is stripped from the mandrel after annealing and slight increase in circumference by rolling. After a subsequent anneal the tube is cut into strips. This Fe has a wide application as it can be drawn or stamped to a great extent without the necessity of intermediate anneals.

A. D. SPILLMAN

Repair of worn components by electrodeposition. J. P. McLARE. *Trans. Faraday Soc.* 20, 87-96 (1924).—The building up of a thick deposit of Fe on a worn mech. part depends primarily on effective surface cleaning of the metal base. It was found necessary to clean successively in gasoline, a boiling alk. electrolytic bath, cold alk. bath, and an electrolytic acid bath, with intermediate washing in clean water. The stages should follow rapidly, without allowing the surface of the metal to become dry, so as

to prevent even traces of corrosion. Excellent deposits of Fe, of good wearing properties, were obtained by the use of a concd. soln. contg. 3-3 1/4 lb. of ferrous NH₄ sulfate per gal., and a c. d. of 18-20 amp. per sq. ft. The soln. should be maintained neutral or within narrow limits of acidity and at a const. temp. not below 18°. Fe may be replaced effectively by Ni in the repair of worn parts and the electrolytic process becomes less complex on account of the comparatively slow change in the compn. of the soln. and the elimination of oxidation. Thick deposits of Ni were obtained at the rate of 0.001 in. per hr. with a c. d. of 20 amp. per sq. ft. of cathode surface, an electrolyte contg. NiSO₄ 2 lb., NiCl₂ 3 1/4 oz., boric acid 4 1/4 oz. per gallon of distd. water being used. Resilient metallic packings were made by coating rubber rings electrolytically with Ag or Pb, employing a film of Ag₂S as a conducting surface on the rubber, but when tested in gun-carriage mountings, the metallic coating invariably split under pressure, allowing access of oil to the rubber.

B. C. A.

Polarization and concentration changes at the cathode during electrolysis of copper salts. A. R. GORDON. *Trans. Roy. Soc. Canada* [iii], **18**, III, 116-7 (1924).—The observed polarization values are much greater than those predicted by theory. On starting the current there is an instantaneous initial polarization π_0 , over and above the IR drop; during electrolysis the polarization increases up to the moment at which H is evolved, in accordance with the equation, $\pi = \pi_0 + 0.188 \log z_0/z$, where z_0 is the concn of Cu in the body of the electrolyte and z its concn at the cathode. The value of π_0 is apparently dependent on the nature of the surface and previous treatment of the cathode.

B. C. A.

Electrolytic solution of copper. R. SAXON. *Chem. News* **131**, 197-8 (1925).—A brief discussion on the production of Fe and Cu from sulfide ores. GEO. DUBERNELL.

The electrolysis of equimolar mixtures. ROBERT SAXON. *Chem. News* **131**, 129-31 (1925).—Some exptl. data are given for the electrolysis of equimolar sulfate solns without free H₂SO₄, such as CuSO₄-ZnSO₄ and Na₂SO₄-CuSO₄. A symbolism is adopted which eliminates the necessity of indicating ions and anions except in special cases. With a mixt. of 3 sulfates, hydroxides of the metals above H₂ in the electrochem. list are produced, the lower ones first. Thus sulfates of Na, Al and Fe give Fe(OH)₃ and then Al(OH)₃.

W. H. BOYNTON

The manufacture of sodium sulfide. HORACE FREEMAN. *Can. Chem. Met.* **9**, 151-2 (1925).—The new elec. furnace process of the Canada Carbide Co., Shawinigan Falls, Quebec, gives a product over 90% pure. A water-cooled furnace shell is used with a sulfide lining. The sulfide is cast into pigs weighing about 900 kg., cooled and crushed. Sixty % hydrate is made by adding 90-95% screenings to the requisite amt. of hot water in a tank with a stirrer. The product is claimed to contain less carbonate, sulfate and other impurities on the basis of its 60% content. The elec. furnace product shows economy in containers, handling, storing, etc.

W. H. BOYNTON

Anaconda electrolytic white lead. R. G. BOWMAN. *Trans. Am. Inst. Min. Met. Eng.* No. 1504, 25 pp. (1925).—The Sperry process, which is a continuous electrolytic process applicable to any basic salt, has been successfully used in making white lead. The process is a combination of electrolysis and chem. pptn. in which the ppt. is neither cathode nor anode and yet is continuously removed. A Pb anode and an Fe cathode are employed. The anolyte is a AcONa soln. contg. a little Na₂CO₃, and the catholyte is a AcONa soln. contg. a relatively large amount of Na₂CO₃. Each soln. is rapidly circulated. The equipment and operation are described and a flow sheet and operating data shown. The white lead produced is claimed to possess finer and more uniformly sized particles of brilliance and stronger covering power than that produced by the older processes.

W. H. BOYNTON

The production of stibine at an antimony cathode in alkaline solution. III. The variation of yield of stibine with the hydroxyl-ion concentration in alkaline and neutral solutions. E. J. WEEKS. *Rec. trav. chim.* **44**, 795-7 (1925) (In English).—The previous results (C. A. **19**, 443, 2455) indicate that there is a definite relationship between the OH-ion concn. of the NaOH soln. and the yield of SbH₃. In the prepn. of SbH₃ at an Sb cathode in alk. and neutral solns., if w = overvoltage, y = % yield of SbH₃, h = voltage between a H₂ electrode immersed in the soln. and a satd. calomel electrode, (OH)⁻ = OH-ion concn., T = abs. temp., K , K_1 , K_2 , C_1 and C_2 = consts., then $w = -0.0282y + C$, $y = 12.6 h - K_2$, $y + 20 = C/T$, $y = C_1 - C_2 \log (\text{OH})$.

E. J. W.

Progress in the electrolytic production of hydrogen and oxygen. A. SANDER. *Z. kompr. u. flüssige Gas* **24**, 29-32 (1925).—Detailed description of the new Schuckert cell and the Homboe cell.

R. L. DODGE

The production of oxygen and hydrogen gases by electrolysis and their application in the arts and industries. J. B. C. KERSHAW. *Ind. Chemist* **1**, 206-9 (1925); cf. C. A.

19, 2170.—A long list of the specific uses of the oxy-hydrogen flame is given for a number of industries. Emphasis is laid upon the necessity for a high degree of purity for O_2 to be used in cutting and welding. Costs of operating a large and a small electrolytic oxygen plant are itemized. Interesting facts are set forth in the following fields: welding, cutting, breaking up large masses of metal, manuf. of platinum lab. vessels and silica ware, production of rubies and sapphires, miscellaneous uses. 2 photographs and 2 drawings. E. G. R. ARDAGH

Restoration of ancient bronzes. COLIN G. FINK AND C. H. ELDRIDGE. *Metropol. Mus. (N. Y.) Report* 1925.—An electrolytic method was developed using 2% NaOH soln. as electrolyte. The bronze to be treated is made cathode and feeble currents are employed. Basic carbonates and oxides in the crust are slowly reduced in place. C. G. F.

Storage batteries. G. W. VINAL. *J. Optical Soc.* 11, 263-74 (1925).—A summary of the characteristics and the operation of storage batteries, and a discussion of factors affecting capacity, characteristics of charging and discharging, resistance, efficiency, and the sources of trouble. Both Pb-acid and Ni-Fe alk. cells are described. The internal resistance of the alk. cell is greater than that of the acid cell and it increases rapidly as the end of the charge is approached. W. H. BOYNTON

The production of fluorescence and phosphorescence by radiation from the carbon arc lamp. W. S. ANDREWS. *Gen. Elec. Rev.* 28, 659 (1925).—A simple app. for producing fine fluorescent effects is described. A C-arc of 5-6 amp., when its light is screened through red-purple ultra glass, will produce fluorescent effects in such compds. as vaseline, anthracene, rhodamin KY, synthetic dyes, uranium glass, Pt Ba cyanide; the sulfides of Zn, Ba, Sr and Ca; and in various solns. put up in clear-glass bottles. A. D. SPILLMAN

Modern (tungsten) lamp making. C. W. MAEDJE. *Nat. Elec. Light Assoc. Bull.* 12, 666 (1925).—A review C. G. F.

Theory and design of ballast resistors. H. A. JONES. *Gen. Elec. Rev.* 28, 650-9 (1925).—A mathematical discussion of the heat losses from a single co-axial filament and a looped wire ballast operating in H gas. The article includes radiation and conduction losses, Langmuir's film theory of convection, thermal conduction, nomograms for use in designing ballast resistors, etc. A. D. SPILLMAN

The manufacture and uses of stellite (LOSEE) 9. Chemistry of the Hybinette Ni-refining process (LATHE) 9. Tungsten (FINK) 9. Electric furnace (U. S. pat. 1,555,401) 19.

Storage batteries. W. KNOBLOCK. U. S. 1,554,823-4, Sept. 22. Structural features.

Storage battery. J. SATO. U. S. 1,555,438, Sept. 29. A paste for battery manuf. comprises an initial mixt. of PbO 88-90, C 7, asbestos 3-5 parts and H_2SO_4 which when given a forming charge in a H_2SO_4 bath of about 1.125 sp. gr. is converted into spongy Pb intermixed with asbestos, C and H_2SO_4 .

Storage battery. W. E. HOLLAND. U. S. 1,554,727, Sept. 22. Structural features.

Storage battery. F. J. WEST. U. S. 1,555,046, Sept. 29. Structural features.

Separator for storage batteries. F. W. DANE. U. S. 1,549,748, Aug. 18. Structural features.

Storage battery grids. W. H. CRISSEY. U. S. 1,550,347, Aug. 18. Structural features.

Grid plates of storage batteries. H. KELLER. U. S. 1,555,012, Sept. 29. Structural features.

Storage battery with specific gravity testing device. O. R. BLATTER. U. S. 1,553,742, Sept. 15. Structural features.

Electric battery. M. VERRON. U. S. 1,550,188, Aug. 18. Structural features of dry batteries.

Dry battery. S. APOSTOLOFF. U. S. 1,552,414, Sept. 8. Structural features.

Dry batteries. MANNESMANN-MOTOREN-WERKE. Brit. 231,135, March 24, 1924. Structural features.

Dry batteries. S. APOSTOLOFF. U. S. 1,553,658-9, Sept. 15. Structural features.

Hermetically sealed dry battery. R. C. BENNER. U. S. 1,549,851, Aug. 18. Production of gas is inhibited by use of $BaCl_2$ or equiv. material in contact with active material of the cell.

Depolarizing mixtures for batteries. G. W. HEISE. U. S. 1,553,530, Sept. 15.

MnO₂ and conductive C are combined in different ratios in different batches which are then separately milled and mixed. Cf. *C. A.* **18**, 1247.

Depolarizer material for batteries. G. W. HEISE and R. C. BENNER. U. S. 1,552,851, Sept. 8. Perforated containers for depolarizing material are treated with S, (NH₄)₂SO₄ or other material innocuous in the electrolyte in order to close the perforations and prevent sifting out of the depolarizing material.

Powder impermeable to liquids for use as a depolarizing material in batteries. R. OPPENHEIM. U. S. 1,552,871, Sept. 8. Porous grains which may be formed of wood charcoal are coated with a pectinized coagulum such as fecula, silica gel, glue or Zn oleomargarate forming a film-like layer on the grains and protecting them against penetration by liquid while permitting free penetration by gases. Cf. *C. A.* **19**, 2606.

Electric smelting furnace. B. G. KLUGH. U. S. 1,554,736, Sept. 22.

Tilting electric furnace. AKT.-GES. BROWN, BOVERI, ET AL. *Brit.* 232,224, April 14, 1924.

Tilting electric furnaces. L. D. KAY. U. S. 1,553,618-9, Sept. 15.

Electric tilting furnace. J. H. GRAY. U. S. 1,554,002, Sept. 15.

Electric furnace of the crucible type. C. B. FOLEY. U. S. 1,554,121, Oct. 6.

Electric resistance furnace. J. YOUNG. U. S. 1,555,542, Sept. 29.

Electric resistance furnace. R. E. HELLMUND. U. S. 1,553,379, Sept. 15.

Electric resistance furnaces. A. D. KEENE. U. S. 1,555,292-3, Sept. 29.

Electric resistance furnace. B. M. S. KALLING. *Brit.* 231,090, Oct. 6, 1924.

High-frequency dielectric furnace. C. T. ALLCUTT. U. S. 1,555,258, Sept. 29. The furnace is adapted for heating material in a crucible.

High-frequency-corona-discharge furnace adapted for heating material in a crucible. C. T. ALLCUTT. U. S. 1,555,259, Sept. 29.

Electric arc furnace adapted for gas reactions. E. EGENAES and O. SANDVOLD. U. S. 1,554,075, Sept. 15. H₂O used for cooling one of the electrodes is introduced into a boiler into which gases heated by the arc are discharged.

Electrolytic recovery of zinc. H. W. GEPP, H. HEY, G. RIGG, R. H. STEVENS and R. T. D. WILLIAMS. U. S. 1,555,567, Sept. 29. Ore, tailings or similar Zn-bearing material is roasted, leached with an acid soln., the soln. is sep'd. and the residue mixed with H₂SO₄ and furnaceed in the presence of SO₂ to solubilize its Zn content. The dissolved Zn is recovered electrolytically.

Zinc from sulfide. E. W. HALE and C. G. FINK. U. S. 1,554,575, Sept. 22. Br dissolved in a soln. of ZnBr₂ or other suitable salt which acts as a solubilizing agent for the Br is used for dissolving Zn from ZnS, the Zn is partially deposited by electrolysis and the electrolytic action is discontinued while the Br liberated remains in soln., the resulting soln. of Br and bromide being used for further treatment of additional ZnS.

Electrodeposition of iron. FER SOC. ANON. *Brit.* 231,179, March 24, 1924. Electrolyte is circulated through parallel troughs (each contg. a rotating cathode) and, in a circulating system, may be treated with air or O with or without steam or may be oxidized by electrolysis with insol. anodes and treated with Fe turnings to neutralize acidity and sep. mud.

Electrodeposition of cadmium and zinc as rustproofing coatings. C. J. WERNLUND. U. S. 1,556,271, Oct. 6. Cd and Zn are deposited from a soln. of their salts, e. g., a soln. formed from Zn cyanide and Ca(OH)₂, in an aq. soln. with NaCN and NaOH. U. S. 1,556,272 specifies the addn. of a Hg compd. such as HgO to the same electrolyte so that Hg is included in the deposited coating metal.

Metal alloy electrodes for use in copper deposition, etc. CHILE EXPLORATION COMPANY. *Brit.* 212,871, Mar. 16, 1923. Electrodes adapted for use as insol. anodes in Cu deposition and resistant to anodic disintegration are preferably formed of Si 23-27, Fe 7-9, Pb 1.9-2.5, Sn 1-2 and Cu 60-65 parts. The electrodes may be activated, before use, to reduce their operating voltage, by using them for 20-30 hrs. as anodes in a cell contg. a weak CuSO₄ or acid soln.

Electrolytic production of aluminium. F. C. FRARY. *Brit.* 232,189, April 10, 1924. See U. S. 1,534,031 (*C. A.* **19**, 1667).

Melting aluminium, magnesium and similar light metals. T. METZGER. U. S. 1,552,865, Sept. 8. In melting Al, Mg and like metals in an elec. induction furnace, the furnace space above the molten charge is filled with inert gas under pressure to produce a total pressure which will eliminate or minimize the pinch effect in the melt.

Nickel anode. N. V. HYBINETTE. U. S. 1,552,609, Sept. 8. At least 0.1% of O is present in Ni anodes used for producing malleable electrolytic Ni and serves to increase soly. of the metal. U. S. 1,552,610 specifies producing Ni anodes by oxidizing a Ni bath, e. g., in a reverberatory furnace, deoxidizing the oxidized bath with a de-

oxidizer (such as Al) which forms a non-gaseous oxide (the deoxidation being insufficient to render the metal tough and malleable) and casting the deoxidized metal.

Iron oxides. C. MONNER. Brit. 230,910, Dec. 18, 1923. $\text{Fe}(\text{OH})_2$ is made by electrolyzing an alkali or alk. earth or other neutral salt with an Fe anode and a platinized C cathode and reacting the ferrous salt and the base either within or outside the cell to form the $\text{Fe}(\text{OH})_2$. The latter is dried and calcined with regulated supply of O to produce the desired oxide.

Reduction of organic compounds with sodium amalgam combined with electrolytic caustic soda production. G. POMA and G. PELLEGRINI. U. S. 1,553,473, Sept. 15. A soln. of an alkali metal salt such as NaCl is continuously electrolyzed in contact with a Hg cathode, so that a Hg amalgam of alkali metal is formed, this amalgam is continuously brought into contact with H_2O to form caustic alkali and into contact with an org. compd. such as PhNO_2 to be reduced, and the Hg is returned to the electrolytic cell.

Carbon disulfide. P. SIEDLER. U. S. 1,549,812, Aug. 18. An elec. current is passed longitudinally through a column of charcoal or other carbonaceous material and S is introduced near one end of the column and the vapors are passed through the column longitudinally and withdrawn from near its other end.

Reactions between gases and liquids electrically induced. S. RUBEN. U. S. 1,554,296, Sept. 22. In promoting reactions between H and cottonseed oil or between other gaseous fluids and liquids having a higher dielec. const. than the gas, an elec. field is maintained through the dielec. liquid and the gas is discharged into close contact with the liquid within the elec. field. An app. is described.

Apparatus for electric purification of gases. H. EDLER. U. S. 1,549,753, Aug. 18. **Apparatus for electric precipitation of suspended particles from gases.** E. OPPEN. Brit. 231,786, Dec. 18, 1924.

Electrolytic cell for producing hydrogen and oxygen from water. W. G. ALLAN. U. S. 1,552,812, Sept. 8.

Apparatus for producing oxygen and hydrogen by electrolysis of water. E. G. LUENING. U. S. 1,555,424, Sept. 29.

Apparatus for separating water and impurities from hydrocarbons, soaps, fats, etc., by electric treatment. M. S. SKAER. U. S. 1,555,231, Sept. 29. The app. is especially designed for sepg. salt water from petroleum.

Material for electric condensers. W. J. COLE, S. G. BROWN and TELEGRAPH CONDENSER CO., LTD. Brit. 230,978, Feb. 28, 1924. A dielectric for elec. condensers is formed of compensating materials having positive and negative temp. coeffs., *e. g.*, of paraffin mixed with 3-5% of gum damar.

Cadmium electroplating. C. J. WERNLUND. U. S. 1,555,537, Sept. 29. In rust-proofing steel airplane parts or other articles by electroplating with Cd from a cyanide bath, the deposition of the Cd is effected in the presence of Hg to produce a Cd coating alloyed with a small proportion of Hg.

Electroplating apparatus. W. F. HALL. U. S. 1,555,468, Sept. 29.

Tumbling apparatus for use in electroplating. F. T. TAYLOR. U. S. 1,555,891, Oct. 6.

Apparatus for electroplating annular objects such as wheel rims. W. W. BENNER. U. S. 1,554,168, Sept. 15.

Anode for electroplating. H. G. RICE. U. S. 1,552,952, Sept. 8. Structural features.

Apparatus for electroplating wires or strips. J. A. PARKER. Brit. 231,997, March 6, 1924.

Polishing-pad and anode for electroplating. P. J. F. BAZENBURG. U. S. 1,552,591, Sept. 8.

Agitating device for electrodepositing apparatus. W. W. McCORD. U. S. 1,552,938, Sept. 8.

5—PHOTOGRAPHY

C. E. MEES

Relation between time and intensity in photographic exposure. II. L. A. JONES AND E. HUSE. *J. Opt. Soc. Am.* 11, 319-40 (1925).—Previously published results showed rather conclusively that (a) there was a definite failure of the reciprocity law, (b) the Schwarzschild equation $E = I t^n$ would not fit the observed values, and (c) the exptl. detn. of the value of "optimal" intensity was subject to great uncertainty due

to the flatness of a large portion of the D -log E curves. Results from further work on Seed 30 and Seed Graflex plates, and Eastman motion picture negative film bear out substantially those previously reported. An attempt was made to interpret the failure of the reciprocity law in terms of the Kron equation, i. e., $N = I.t.10^{-2}(\log I/I_0)^2 + 1)^{1/2}$. This formula when applied to some of these experimental data gives very satisfactory agreement. In the case of one of the materials investigated, Kron's formula could not be applied with the same certainty as with the others, since in making the exposures, sufficiently high values of intensity to make possible the definite detn. of log I_0 were not used.

Exposure and development of printing-out paper. E. STENGER. *Camera (Luzern)* 3, 271-3; 4, 11-3, 39-42(1925).—Printing-out papers may be given a short exposure and physically developed. Various tones are thus obtained without the use of noble metals. The developed prints are more permanent than those made by the printing-out process and toned with noble metals. The physical developer soln. contains no sol. Ag salts, since use is made of those present in the paper. Formulas are given.

MERRILL W. SEYMOUR

Extra-sensitized bromide papers. K. JACOBSON. *Brit. J. Phot.* 72, 513(1925).—Bromide papers sensitized with a 1:1,000,000 soln. of erythrosin contg. 2 drops of NH_4OH to 3.5 oz. of sensitizing soln. require 25-50% the exposure of an untreated paper. By using pinakryptol green, development may be conducted in the ordinary bright light. Sensitizing with pinachrome raises the sensitiveness as much as 8-15 times and it is thus possible to use papers in some cases as a substitute for plates.

G. E. M.

Daylight printing with mercury. A. STEIGMANN. *Brit. J. Phot.* 72, 514(1925); cf. C. A. 19, 2306.—Papers coated with a mixt. of 8% HgCl_2 , double the quantity of 8% $(\text{NH}_4)_2\text{C}_2\text{O}_4$, and a few drops of NH_4OH , after several min. exposure to daylight followed by subsequent phys. development, yield a gray-black print simulating charcoal drawings in quality. The process is flexible and may be made to yield soft or hard results.

G. E. MATTHEWS

New method of printing on gaslight paper. B. HEDLUND. *Camera (Luzern)* 3, 261-3; *Atelier Phot.* 32, 46-8(1925).—A method is described for prepg. a yellowish paper by development. A print is made in the ordinary way and developed. After development is stopped with an acetic acid bath, the print is exposed to daylight and then fixed in hypo.

J. F. ROSS

Structure and composition of silver bromide gelatin plates, films and developing-out papers. J. M. EDER. *Camera (Luzern)* 4, 29-31(1925).—Statistics are given regarding the total thickness, AgBr content, grain size, etc., of various plates, films and papers. Information about the compn. and properties of film bases is also given.

M. W. SEYMOUR

Standard light-source for plate testing. ANON. *Brit. J. Phot.* 72, 518, 20(1925). Report of a committee from the Optical Soc. of America presented to the 1925 International Congress of Photography. Recommendations made are: (1) Photographic unit of intensity be defined as one visual candle power of radiation having a spectral compn. identical to that emitted by a complete radiator (black body) at a temp. of 5000° K. (2) In the detn. of speed, that the illumination incident on the photographic material shall be not less than 1.0, nor greater than 10.0 meter candles. (3) That the exposure be non-intermittent and that the variation in exposure be produced by a variation of the time factor of exposure. With materials of different color sensitivities, of ordinary color sensitivity and with pure bromide emulsions, a low-temp. source (2360° K.) does not give values which are proportional to the speeds detd. in terms of sunlight, at which the majority of photographic materials are exposed. A close approximation to that of noon sunlight, of a complete radiator operating at a temp. of 5000° K. may be obtained by the use of any one of the following filters in conjunction with a light source operating at a color temp. of 2360° K.: (1) Wratten light filter No. 79; (2) a 6-mm. sheet of Macbeth daylight blue glass; (3) two cells each of 1 cm. thickness, one contg. a 3% soln. of CuSO_4 , and the other a 0.5% soln. of CuSO_4 with sufficient NH_3 completely to convert the CuSO_4 to ammoniacal CuSO_4 . The Eastman standard acetylene burner is described and tests from several laboratories show that the burner gives a value of 2360° K. Standardized incandescent elec. lamps which may be made to operate at 2360° K. can be obtained from the National Standardizing Bureaus. The photographic plate fails to integrate intermittent exposures, and therefore plate speeds should be measured with a non-intermittent sensitometer and it is much more convenient to vary the time factor than the intensity factor.

G. E. MATTHEWS

Selenium toning on silver bromide papers. A. STEIGMANN. *Atelier Phot.* 32, 48-9(1925).—A method is given for changing the color of a Se-toned print or trans-

parency. The Ag selenide image is placed in a bleach bath contg. KI, KBr and $\text{KF}_3\text{-e}(\text{CN})_6$. The Ag selenide is converted into AgI and yellowish red Se iodide. The Ag halide is then reduced with light or removed by fixing. Tone gradations are obtained by varying the length of time the Ag selenide image is left in the iodide bleach bath.

J. F. ROSS

The history and theory of the latent image. III. LÜPPO-CRAMER. *Z. wiss. Phot.* 23, 216-26(1925); cf. *C. A.* 19, 2787.—L.-C. discusses at length, but without adducing any new exptl. evidence, the literature from 1839 to the present time on the clouding, pulverizing, or other mech. changes by the action of light, which have been observed in films contg. or consisting of AgI or AgBr.

E. R. BULLOCK

The photographic activity of methylene blue as an adsorption effect. J. EGGERT AND J. REITSTOTTER. *Kolloid-Z.*, Special No., Apr. 1, 1925, 298-305.—When AgBr-gelatin plates are washed in a soln. of methylene blue (even when the concn. is as low as $1:10^6$ or $1:10^{-6}$) the sensitivity is decreased. AgBr adsorbs methylene blue almost quantitatively. To 50-cc. samples of a AgBr-photographic emulsion were added 10-cc. portions of methylene blue solns. whose concns. in g. per cc. were 0, 10^{-7} , 10^{-6} , 10^{-5} and 10^{-4} . When the plates were exposed and developed in the same way, the sensitivity of the plates was found to decrease with increasing concn. of methylene blue. Together with the decrease in sensitivity appears a "veil" on the negative. These effects do not appear, if the adsorbing AgBr is dissolved out with $\text{Na}_2\text{S}_2\text{O}_3$, and the image developed physically. When the concn. of methylene blue was 10^{-4} g. per cc. the developed plate was entirely black. A calcn. of the dimensions of the AgBr grains and the surface covered by a mol. of methylene blue shows that only 2.5% of the surface of the AgBr grains could have been covered. The time spent in developing does not affect the veiling effect. Whenever there are about 5.10^3 methylene blue mols. per grain of AgBr a rapid decrease of sensitiveness and an increase of veiling appears. Methylene blue makes the AgBr grain susceptible to development. Such grains are not further changed by light so the sensitiveness is decreased. All such grains are developed whether reached by light or not; so a veiling of the plate appears. The adsorbed dye does not prevent the light from reaching the AgBr. The presence of S in methylene blue is at least partially responsible for this action. However S-free substances, such as Janus green, have similar effects.

F. E. BROWN

Laws of development of X-ray films. R. B. WILSEY. *Radiology* 5, 237-44(1925).—Contrast is found to increase with development time to a max., and then decreases owing to the growth of fog over the lower densities. As a rule, the lower the fog, the greater is the contrast and the longer is the range of satisfactory development times. The relation between exposure and development time to give equal density of radiograph is shown graphically. The correct time of development of a used developer can be detd. by measuring the time of appearance of the image and multiplying by the Watkins factor. The use of a hardening bath between development and fixing permits development of X-ray films to be carried out at temp. up to 90°F .

R. B. W.

Platinum bath. F. FORMSTECHE. *Camera (Luzern)* 3, 268-70(1925).— $\text{K}_2\text{-PtCl}_4$ is always used for the prepn. of Pt toning baths rather than K_2PtCl_6 , because more Pt is deposited by a given quantity of Ag from soln. in which the Pt is in the lower state of oxidation. Neutral or alk. Pt solns. tone very slowly. Acid solns. are always used. The ionization of the Pt salts is greater in the acid baths since hydrolysis is suppressed. Boric, acetic, oxalic, tartaric and especially formic acid cause premature exhaustion of the bath by deposition of metallic Pt. Baths that keep well and tone rapidly may be prepd. with H_2SO_4 , HCl, HNO_3 , H_3PO_4 , citric and lactic acids. Of these, F. considers lactic acid the best, since it does not reduce the Pt salts or attack the half tones. Prints toned by combined Au and Pt toning are apt to develop spots due to the galvanic action of the 2 metals. Attempts to revive exhausted Pt baths by means of acids should not be made. Prints should be thoroughly washed and then placed in a NaCl bath before toning in order that sol. Ag salts may not be carried over into the Pt bath.

M. W. SEYMOUR

Chemistry of the acid fixing and hardening bath. II. The precipitate from the interaction of developer with acid fixing and hardening baths. S. E. SHEPPARD AND A. BALLARD. *J. Frank Inst.* 200, 537-8(1925).—It is found that the ratio of H_2SO_4 to alumina in the ppt. formed when alkali and sulfite and developing soln. are added to an acid fixing bath depends on the final H-ion concn. of the soln. The H_2SO_4 content decreases steadily as the p_{H} increases. While it is possible that a series of basic Al sulfates is formed, there was no direct evidence in favor of this, the compn. of the ppt. varying continuously.

S. E. SHEPPARD

Solarization. T. S. PRICE. *Brit. J. Phot.* 72, 506-7(1925).—A critical account of

that part of Arens' dissertation on the interpretation of photographic reversal phenomena (*Z. physik. Chem.* **114**, 338-70) that deals with reversal by the sufficient action of one kind of radiant, chem., or mech. energy. The validity of Arens' objections to the theories of Baur (1903) and Lüppe-Cramer (1911) is considered and approved; and Arens' own theory of diminished catalytic activity in consequence of a "coagulation" of the latent image (silver) nuclei with increasing exposure, is then criticized. It is shown that his exptl. basis is at best ambiguous, and doubt is expressed as to the mech. possibility of the required coagulation occurring under the conditions of a solarizing exposure.

E. R. BULLOCK

Formation of Ag in Ag halides under intense illumination (KOCH, VÖGLER) **3**.
Isopropyl-*p*-aminophenol [for photographic developers] (U. S. pat. 1,555,452) **10**.

Color photography. L. TOLNAY and L. KOVASZNAV. Brit. 231,717, July 7, 1924. Special features involving the manuf. and use of 3 separable superimposed layers each sensitized for a different part of the spectrum, with interposed color screens.

Color photography (built-up films). J. E. THORNTON. Brit. 230,965, Feb. 15, 1924.

Color photography (built-up films). J. E. THORNTON. Brit. 231,030, May 7, 1924.

Color photography (built-up films). J. E. THORNTON. Brit. 231,058, July 16, 1924.

Color photography (using superposed differently colored images). L. PREISS. Brit. 231,137, March 24, 1924.

Photographic films. J. H. HASTE. Brit. 232,232, April 14, 1924. Different layers of a laminated film are united by the use of a special coating mixt. which may comprise nitrocellulose dissolved in fusel oil or BuOH, acetone and MeOH. Cf. *C. A.* **19**, 1668.

Light-sensitive film. T. FREUNDORFER and R. FREUNDORFER. U. S. 1,552,428, Sept. 8. An ammoniacal shellac soln. and a sol. dichromate are used to form coatings for making etched photo-mechanical printing plates, etc.

Photographic sensitizers. M. MARTINEZ. Brit. 232,307, Jan. 9, 1924. Hg(CN)₂ or a mixt. of a Hg salt and a cyanide is employed in a photographically sensitive surface which may also include alkali oxalates, with or without a bromide, or tartrates, chloral, alkali chlorides, ferric salts and AgNO₃, an albumin or gelatin size, small quantities of oxalic, tartaric or acetic acids, Na sulfite or phosphate, SnCl₄ or NH₃. To increase the speed there may be added basic Hg cyanide, fluorescein or its Na salt, a halogen acid, a thiocyanate, formic acid or a formate, MeOH, EtOH, acetone and "suitable sizes and colloids."

Photographic reversal process. L. J. G. VAN EWIJK and H. J. PRINS. Brit. 231,246, Jan. 2, 1924. The process of producing reversed images from developed but unfixed Ag images by removing the developed image, exposing a second time to light, and re-developing, is modified by making the second exposure to light before the primary negative image is removed.

Photographic reversal process. J. G. CAPSTAFF. U. S. 1,552,791, Sept. 8. A Ag image is removed, *e. g.*, by KMnO₄ and H₂SO₄ soln., leaving an image of Ag salts which is then retransformed into a permanent visual image, *e. g.*, by an ordinary developer. Some of the Ag salts are removed before the transformation is complete, by the action of Na₂S₂O₃ soln.

Projection screens. W. G. MORSE. Brit. 232,237, April 10, 1924. Cloth screens may be coated with a mixt. of MgCO₃, linseed oil, turpentine and white driers, with or without other ingredients.

6—INORGANIC CHEMISTRY

A. R. MIDDLETON

Complexes of quinquevalent molybdenum. G. SCAGLIARINI. *Atti. accad. Lincei* [6], **1**, 676-9 (1925).—S. and Tartarini (*C. A.* **17**, 2400; **18**, 362, 1251) found that complexes of tervalent metals (including those of Mo^{III} with HCNS) resist hydrolysis. The complexes of Mo^V are easily hydrolyzed. The decomposition is indicated by color changes when the free acid is insufficient to prevent hydrolysis. Barbieri (*C. A.* **14**, 906) studied the complexes of Mo^V with HCNS and showed that the Braun reaction depends upon a successive hydrolysis. Klason's salt (I), (NH₄)₂MoOCl₅, studied by

Mauro and Danesi and by Friedheim and Euler (*Ber.* 28, 2061) is emerald-green when dry, but with H_2O this color disappears and the solns. vary from dark brown, brick-red bright red, orange or yellow, in color depending on the diln. and the degree of successive hydrolysis. The products are too sol. to be crystd. In hydrolyzing this compd. it may behave either as a double salt or as a complex salt; in fact the products of the 2 schemes of hydrolysis are in equi. A pyridine acetate soln. slightly acid with AcOH added to a cold satd. soln. of 1 ppts. in the course of 2 days brick-red crystals of *molybdenyl pyridine chloride*, $\text{MoOCl}_3 \cdot \text{C}_5\text{H}_5\text{N}$, in which I has hydrolyzed giving NH_4Cl and MoOCl_3 , of which the latter is fixed by $\text{C}_6\text{H}_5\text{N}$. Ten g. I in 50 cc. EtOH + 15 cc. H_2O were filtered and treated with a satd. H_2O soln. of 5 g. hexamethylenetetramine contg. 2 cc. HCl and 10 g. EtOH. A dark red cryst. ppt. is obtained of a double salt, $[(\text{NH}_4)_2(\text{Mo}(\text{OH})_4)] \cdot \text{C}_6\text{H}_{12}\text{N}_4 \cdot \text{HCl}$, or $2(\text{MoO}_2\text{Cl}) \cdot 4\text{NH}_4\text{Cl} \cdot 4\text{H}_2\text{O} \cdot \text{C}_6\text{H}_{12}\text{N}_4 \cdot \text{HCl}$, which is formed from the product of the other type of hydrolysis in which $(\text{NH}_4)_2\text{Mo}(\text{OH})_4\text{Cl}_3$ is the intermediate product in question. The 2nd formula for this salt is similar to that of an oxalate, $(\text{MoO}_2)_2\text{C}_2\text{O}_4 \cdot 2(\text{NH}_4)_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ obtained by B. (*loc. cit.*). E. J. WITZEMANN

Alkyl compounds of thallium. ERICH KRAUSE AND ARISTID V. GROSSE. *Ber.* 58B, 1933-9(1925).—The following new compds. were prepd.: *n*-dibutylthallallic chloride, bromide, iodide, fluoride, nitrate, sulfate; diisobutylthallallic chloride, nitrate; diisooamylthallallic fluoride, chloride; diisopropylthallallic chloride, nitrate; sec-dibutylthallallic chloride, nitrate; dicyclohexylthallallic chloride, nitrate. The general method of prepn. is to add a small excess of alkyl Mg halide, drop by drop, to an ether soln. of thallallic halide.

R. J. HAVIGHURST

Interaction of nitrogen sulfide and sulfur: Nitrogen persulfide. F. L. USHER. *J. Chem. Soc.* 127, 730-5(1925).—Sublimation of N sulfide contg. free S over silver gauze at about 125° yields a film of a ruby-red compd. which turns deep blue on keeping ($\frac{1}{2}$ hr.-2 days) or on warming at 50° , and behaves like blue N sulfide (Burt, *C. A.* 4, 2419). N sulfide free from S yields directly the blue compd. from which the ruby compd. could never be obtained. These modifications are considered to be produced from different intermediate volatile N sulfides, the one giving rise to the ruby compd. being formed by the decompn. of *nitrogen persulfide*, NS_2 , by Ag. NS_2 is obtained as a dark red liquid, resembling Br, and solidifying to a pale yellow solid at the temp. of solid CO_2 , by subliming N sulfide with S at 125° in the absence of Ag gauze. It has a penetrating odor like that of I and can be distd. unchanged in a vacuum. At the ordinary temp. it decomposes slowly into S and yellow N sulfide. Water decomposes it into NH_4 salts and free S. It is more volatile than the sulfide N_4S_4 ; H_2S decolorizes an ethereal soln. with probable formation of a thio acid of N.

B. C. A.

The arsenates of tervalent manganese. I. EUGEN DEISS. *Z. anorg. allgem. Chem.* 145, 365-77(1925).—The violet manganiarsenate soln. of Barreswil (*Compt. rend.* 44, 677(1857)) is shown to possess its coloring because of the presence of triarsenatomanganic acid $[\text{Mn}(\text{AsO}_4)_3]\text{H}_4 + 3\text{H}_2\text{O}$. This compd. may be prepd. by addn. of manganic acetate, manganic hydroxide, or Christensen's "manganic acetate soln." to cold concd. arsenic acid soln. It may also be prepd. by adding a soln. of manganous acetate in arsenic acid to a soln. of KMnO_4 in arsenic acid. Triarsenatomanganic acid forms violet-red crystals, whose properties are described. The brown "manganic acetate soln." of Christensen (*J. prakt. Chem.* 28, 16(1883)) shows properties different from cryst. bright-red manganic acetate, indicating that the latter has undergone a change in Christensen's soln.

R. J. HAVIGHURST

Asymmetrical derivatives of boron. J. BÖSEKEN AND J. A. MIJS. *Rec. trav. chim.* 44, 758-62(1925).—In a previous paper B. has shown (*C. A.* 17, 2803) that in the B complexes of salicylic acid, pyrocatechol, etc., the B may be considered to have a coordination no. of 4 and to constitute the bond that joins 2 rings placed one above the other. This would permit of the existence of asymmetric compds. From the strychnine salt of disalicyloboric acid a fraction was sep'd. having a higher rotatory power than the rest (Meulenhoff and B., *C. A.* 18, 1998). Other instances were sought among the derivs. of pyrocatechol since the latter itself does not show the effect. 1,2,4-Chloropyrocatechol-boric acid (I) and its cryst. K, NH_4 , PhNH_2 , $p\text{-ClC}_6\text{H}_4\text{NH}_2$, $p\text{-IC}_6\text{H}_4\text{NH}_2$ and *o*- $\text{MeC}_6\text{H}_4\text{NH}_2$ salts were prep'd. Equimol. amts. of I and brucine were dissolved in 86% EtOH. On evapp., needles contg. 6 mols. of H_2O of crystn. were obtained. Several fractions were obtained with about the same rotation. The brucine salt was then prep'd. quickly and dried over P_2O_5 and dissolved in dry CHCl_3 . The soln. was fractionally ppt'd. with ligroin. Six fractions with $[\alpha]_D$ ranging from -5.9° to -19.7° ($[\alpha]_D$ for racemic-form -13.7°) were obtained. Probably $[\alpha]_D$ for the pure *d*-l' salt is less than -5.9° and may be positive. The last fraction contained an excess of the

l-l' form. Meulenhoff (*C. A.* 19, 2178) obtained 1,2,3- and 1,2,4-nitropyrocatechol (II and III) but better results are obtained by Dakin's method (*C. A.* 4, 1156) slightly modified (yield 25% II and 45% III). II is more sol. and was converted into 1,2,3-nitropyrocatechol-boric acid and the $PhNH_2$, $p-ClC_6H_4NH_2$, *brucine*, *strychnine*, *quinine*, *cinchonine* and *cinchonidine* salts. The dry strychnine salt in dry $CHCl_3$ was pptd. in 7 fractions with dry ligroin having $[\alpha]_D -68.7^\circ$ to -55.2° . After 8 days these showed $[\alpha]_D -60.4^\circ$ to -58.3° . The 1st fraction was extd. some days with dry ligroin + a little dry $CHCl_3$ and then showed -71.7° ; the *l-l'* isomer is less sol. and is concd. in the 1st fractions. The last fraction is richest in the *d-l'* isomer. E. J. W.

The reactivity of silver with oxygen. N. PARRAVANO AND G. MALQUORI. *Atti accad. Lincei* [6], 1, 622-6(1925).—By the method described in a previous paper (*Atti accad. Lincei* [6], 1, 417(1925)) P. and M. detd. the capacity of mol. O_2 to oxidize Ag by heating Ag prepd. in various ways in an O medium. Four specimens were used: (1) fine Ag powder obtained by pptg. Ag_2O-NH_4OH soln with glucose in the cold; (2) coarser Ag powder pptd. from the same soln with $NaHSO_3$; (3) dendritic Ag crystals prepd. electrolytically; (4) Ag in a compact mass. 15 g. of each was placed in a hard-glass bulb in contact with 93 cc. O at 675 mm. The temp. was raised 1° in 10 secs. up to 400° . (3) and (4) were inert to O ; (1) absorbed O definitely at 130° while (2) did so at 250° . At 300° all O absorbed had been expelled again, which makes it doubtful if it was combined as Ag_2O . The finely divided state of the metal suppresses part of the passive resistance that opposes oxidation but the temp. was raised so rapidly that it was not detd. whether or not a reaction temp. corresponds to an equil. state. When the 4 specimens were heated for 5 hrs. at 156° , 193° , 213° , 230° and 250° resp., the greatest O absorption occurred at 193° and 213° for (1) and (2). (3) and (4) failed to absorb O . The velocity of absorption was different for (1) and (2) and increases up to 213° . E. J. WITZEMANN

The interaction of sodium chloride and alumina. F. H. CLEWS. *J. Chem. Soc.* 127, 735-9(1925).—At temps. of $830-1050^\circ$ and in the presence of moist air the following 3 reactions were observed. (A) $4xNaCl + yAl_2O_3 + xO_2 = 2xNa_2O.yAl_2O_3 + 2xCl_2$; (B) $2xNaCl + yAl_2O_3 + xH_2O = xNa_2O.yAl_2O_3 + 2xHCl$; (C) $4HCl + O_2 = 2H_2O + 2Cl_2$. Reaction (B) predominates, the evidence being that the Cl formed is due more to (C) than to (A). By using atms. of $H_2O + HCl$ attempts were made to det. equil. conditions for (B), but no quant. relation could be found between the compn. of the solid and gaseous phases. It appears that for complete reaction of $NaCl$ with Al_2O_3 in the presence of H_2O an excess of Al_2O_3 is of greater importance than one of H_2O . The stability of Na aluminate with reference to HCl decreases rapidly from 1015° , at which temp. the mol. ratio of Al_2O_3/Na_2O becomes less than 10/1, to 830° , at which temp. it is less than 12/1. Wm. B. PLUMMER

Equilibrium in systems of the type $Al_2(SO_4)_3-M^{II}SO_4-H_2O$. I. Aluminium sulfate-copper sulfate-water, and aluminium sulfate-manganese sulfate-water, at 30° . R. M. CAVEN AND T. C. MITCHELL. *J. Chem. Soc.* 127, 527-31(1925).—Equil. diagrams for the above 2 systems are given. No double salt is formed between $Al_2(SO_4)_3$ and $CuSO_4$, but in the 2nd system the double salt $Al_2(SO_4)_3.M^{II}SO_4.22H_2O$ is formed as a solid phase consisting of fine needles having the property of "knotting up into masses not unlike tapioca." This salt is presumably the same as the naturally occurring apjohnite. Wm. B. PLUMMER

Decolorization of carbon disulfide solutions of iodine by red phosphorus. R. N. TRAXLER AND F. E. B. GERMANN. *J. Phys. Chem.* 29, 1119-24(1925).—The decolorization observed by Sestini (*Gazz. chim. ital.* 1, 323(1871)), was not due to adsorption but to reaction between P and I_2 . Except with extremely dry reagents, the PI_3 formed was partly hydrolyzed to HI and H_3PO_3 which, being insol. in CS_2 , were both pptd. on the excess P. Repeated exposures to CS_2 solns. of I_2 of a sample of red P, purified in various ways to remove yellow P, decreased its wt. uniformly 18.5%, leaving an inactive reddish-violet P, which may be a new modification. PI_3 obtained from I_2 and red or yellow P in CS_2 m. 55° , though pure PI_3 m. 61° . The lower m. p. was ascribed to some S compd., probably $P_4S_3I_6$, m. 119.5° . By using CS_2 freshly purified from S by Hg, a convenient prepn. of PI_3 results. A. W. FRANCIS

The so-called suboxide of lead. A. E. VAN ARKEL. *Rec. trav. chim.* 44, 652-4(1925).—So-called suboxide of Pb prepd. by Pelouze (Guttersohp, *C. A.* 18, 2946) obtained by careful decompn. of PbC_2O_4 was investigated by the X-ray method and found to be a mixt. of Pb and red oxide (tetragonal). E. J. WITZEMANN

Application to chromium of a general method for synthesis of fluorides and silicates. A. DUBOIN. *Compt. rend.* 181, 336-7(1925).— $CrF_3.3KF$ was made when to fused KHF_2 was added gradually Cr_2O_3 or CrF_2 , and after heating to redness, SiO_2 . In some expts.

this melt was heated further with KCl 48 hrs.⁹ The SiO₂ was recovered as tridymite, d. 2.32. The CrF₃·3KF, d. 2.93, was sol. in HCl and HNO₃. It was dissolved for analysis in HCl and the *F* detd. as CaF₂. A. W. FRANCIS⁹

Investigation of hypochlorous acid and the alkali hypochlorites. R. DIETZEL AND F. SCHLEMMER. *Z. anorg. allgem. Chem.* **145**, 381-93(1925).—The course of the reaction $2\text{NaOH} + \text{Cl}_2 \rightarrow \text{NaOCl} + \text{NaCl} + \text{H}_2\text{O}$ was investigated by titrimetric methods and by an ultra-violet spectrographic method. On the assumption that the above equation is correct, a molar concn. of Cl₂ in NaOH should produce a molar NaOCl soln. Titrations with thiosulfate, arsenious acid, and AgNO₃ all failed to give the expected yield of chlorite and chloride ion. In the most favorable cases, a 0.5 *M* soln. of hypochlorite was obtained. The conclusion is that a part of the Cl is bound in such a way that it is inaccessible to ordinary titrating agents. The ultra-violet spectrograph failed to locate the rest of the Cl. Hypochlorite solns. of less than 0.5 *M* concn. are quite stable if kept under proper conditions. If the hypochlorite soln. contains an excess of free Cl₂ or HClO, there is a rapid change according to the equation $\text{ClO}^- + 2\text{HClO} \rightarrow \text{ClO}_3^- + 2\text{H}^+ + 2\text{Cl}^-$. Small amts of free acid suffice to start this reaction. R. J. HAVIGHURST

Electrolytic preparation of selenides and iodides (FISCHER) 2. Electrolytic preparation of H₂S and of metal sulfides (FISCHER) 2.

7—ANALYTICAL CHEMISTRY

WM. T. HALL

Critical studies on methods of analysis. L. A. CONGDON, A. B. GUSS AND F. A. WINTER. *Chem. News* **131**, 65-8, 81-4, 97-100, 113-7(1925).—Over 100 methods for the detn. of Zn are discussed briefly and expts. with the gravimetric detn. as ZnNH₄PO₄, Zn₂P₂O₇, ZnS, ZnO and ZnSO₄ and with the volumetric detn. by means of K₄Fe(CN)₆ show that most of the published procedures are capable of giving very satisfactory results in solns. contg. pure Zn salts. W. T. H.

The approximation method for preparing normal solutions. FRITZ PREGL. *Z. anal. Chem.* **67**, 23-7(1925).—Complete details are given for the prepn. of HCl and carbonate-free NaOH solns. which shall be exactly 0.1 *N*. W. T. H.

The use of dyestuffs in analytical chemistry. F. WM. ATACK. *Can. Chem. Metallurgy* **9**, 201-2(1925).—The various uses of methylene blue are described. W. T. H.

Acidimetry and alkalimetry. H. ÖMAN. *Svensk Kem. Tids.* **37**, 107-15(1925).—An examn. of the limits of error including in the reckoning the dissociation of the acid. The discussion is illustrated by several titrations of 0.01 *N* solns. with errors of the order of 0.01% for macro and ±0.0015 on 0.5 cc. (micro) vols. A. R. ROSE

Extemporaneous Fehling solution. G. PÉGURIER. *Rept. pharm.* **36**, 257-60(1925).—Three stock solns are prepd.: (A) a filtered soln. of 150 g. tartaric acid in 450 cc. of H₂O; (B) a soln. of 52.5 g. CuSO₄ in 250 cc. of H₂O and 10 drops of H₂SO₄; (C) NaOH soln. *via* French Codex. In applying the test, a mixt. of 45 cc. of A, 25 cc. of B, and sufficient C to make 150 cc. of the finished soln. is prepd. in the order named. W. O. E.

Simple method for standardizing balance weights. N. K. HARVEY. *Chem. Eng. Mining Rev.* **17**, 205-6(1925).—The method depends on the assumption that in an av. box of wts. some may be heavier and some lighter than their face value, but none will depart very much from its face value. The rider should be nearly the same wt. as the 0.01 g. wts. Assume the rider weighs exactly 0.01 g., and calc. the value of each wt. by successively comparing the wts. with one another, and the 0.01 g. wts. with the rider. Calc. the actual wt. of the rider from the formula $Ea/b = -e$, in which *E* is the calcd. difference of the largest wt. from its face value, *a* and *b* are the smallest and largest wts., resp. and *e* is the difference of the rider wt. from its face value; and recalc. the actual values of the other wts. A. PAPINEAU-COUTURE

Quantitative variations of mixtures of two homogeneous salts and a new indirect method of quantitative analysis. G. COMELLA. *Ann. chim. applicata* **15**, 123-36(1925).—Unlike numerous methods proposed in the past for detg. the components of such mixts. as NaCl + KCl, the new method is based on arithmetic progression and allows the independent calcn. of the components. If a soln. of definite Cl normality

to prevent even traces of corrosion. Excellent deposits of Fe, of good wearing properties, were obtained by the use of a concd. soln. contg. $3\text{--}3\frac{3}{4}$ lb. of ferrous NH_4 sulfate per gal., and a c. d. of 18–20 amp. per sq. ft. The soln. should be maintained neutral or within narrow limits of acidity and at a const. temp. not below 18° . Fe may be replaced effectively by Ni in the repair of worn parts and the electrolytic process becomes less complex on account of the comparatively slow change in the compn. of the soln. and the elimination of oxidation. Thick deposits of Ni were obtained at the rate of 0.001 in. per hr. with a c. d. of 20 amp. per sq. ft. of cathode surface, an electrolyte contg. NiSO_4 2 lb., NiCl_2 $3\frac{1}{4}$ oz., boric acid $4\frac{3}{4}$ oz. per gallon of distd. water being used. Resilient metallic packings were made by coating rubber rings electrolytically with Ag or Pb, employing a film of Ag_2S as a conducting surface on the rubber, but when tested in gun-carriage mountings, the metallic coating invariably split under pressure, allowing access of oil to the rubber. B. C. A.

Polarization and concentration changes at the cathode during electrolysis of copper salts. A. R. GORDON. *Trans. Roy. Soc. Canada* [iii], 18, III, 116–7 (1924).—The observed polarization values are much greater than those predicted by theory. On starting the current there is an instantaneous initial polarization π_0 , over and above the CR drop; during electrolysis the polarization increases up to the moment at which H is evolved, in accordance with the equation, $\pi = \pi_0 + 0.188 \log z_0/z$, where z_0 is the concn. of Cu in the body of the electrolyte and z its concn. at the cathode. The value of π_0 is apparently dependent on the nature of the surface and previous treatment of the cathode. B. C. A.

Electrolytic solution of copper. R. SAXON. *Chem. News* 131, 197–8 (1925).—A brief discussion on the production of Fe and Cu from sulfide ores. GEO. DUBERNELL.

The electrolysis of equimolar mixtures. ROBERT SAXON. *Chem. News* 131, 129–31 (1925).—Some exptl. data are given for the electrolysis of equimolar sulfate solns. without free H_2SO_4 , such as $\text{CuSO}_4\text{--ZnSO}_4$ and $\text{Na}_2\text{SO}_4\text{--CuSO}_4$. A symbolism is adopted which eliminates the necessity of indicating ions and anions except in special cases. With a mixt. of 3 sulfates, hydroxides of the metals above H_2 in the electrochem. list are produced, the lower ones first. Thus sulfates of Na, Al and Fe give $\text{Fe}(\text{OH})_3$ and then $\text{Al}(\text{OH})_3$. W. H. BOYNTON

The manufacture of sodium sulfide. HORACE FREEMAN. *Can. Chem. Met.* 9, 151–2 (1925).—The new elec. furnace process of the Canada Carbide Co., Shawinigan Falls, Quebec, gives a product over 90% pure. A water-cooled furnace shell is used with a sulfide lining. The sulfide is cast into pigs weighing about 900 kg., cooled and crushed. Sixty % hydrate is made by adding 90–95% screenings to the requisite amt. of hot water in a tank with a stirrer. The product is claimed to contain less carbonate, sulfate and other impurities on the basis of its 60% content. The elec. furnace product shows economy in containers, handling, storing, etc. W. H. BOYNTON

Anaconda electrolytic white lead. R. G. BOWMAN. *Trans. Am. Inst. Min. Met. Eng. No. 1504*, 25 pp. (1925).—The Sperry process, which is a continuous electrolytic process applicable to any basic salt, has been successfully used in making white lead. The process is a combination of electrolysis and chem. pptn. in which the ppt. is neither cathode nor anode and yet is continuously removed. A Pb anode and an Fe cathode are employed. The anolyte is a AcONa soln. contg. a little Na_2CO_3 , and the catholyte is a AcONa soln. contg. a relatively large amount of Na_2CO_3 . Each soln. is rapidly circulated. The equipment and operation are described and a flow sheet and operating data shown. The white lead produced is claimed to possess finer and more uniformly sized particles of brilliance and stronger covering power than that produced by the older processes. W. H. BOYNTON

The production of stibine at an antimony cathode in alkaline solution. III. The variation of yield of stibine with the hydroxyl-ion concentration in alkaline and neutral solutions. E. J. WEEKS. *Rec. trav. chim.* 44, 795–7 (1925) (In English).—The previous results (*C. A.* 19, 443, 2455) indicate that there is a definite relationship between the OH^- -ion concn. of the NaOH soln. and the yield of SbH_3 . In the prepn. of SbH_3 at an Sb cathode in alk. and neutral solns., if w = overvoltage, y = % yield of SbH_3 , h = voltage between a H_2 electrode immersed in the soln. and a satd. calomel electrode, $(\text{OH})^-$ = OH^- -ion concn., T = abs. temp., K, K_1, K_2, C_1 and C_2 = consts., then $w = -0.028_2y + C, y = 12.6h - K_2, y + 20 = C/T, y = C_1 - C_2 \log (\text{OH})^-$. E. J. W.

Progress in the electrolytic production of hydrogen and oxygen. A. SANDER. *Z. kompr. u. flüssige Gase* 24, 29–32 (1925).—Detailed description of the new Schuckert cell and the Homboe cell. R. L. DODGE

The production of oxygen and hydrogen gases by electrolysis and their application in the arts and industries. J. B. C. KERSHAW. *Ind. Chemist* 1, 206–9 (1925); cf. *C. A.*

19, 2170.—A long list of the specific uses of the oxy-hydrogen flame is given for a number of industries. Emphasis is laid upon the necessity for a high degree of purity for O_2 to be used in cutting and welding. Costs of operating a large and a small electrolytic oxygen plant are itemized. • Interesting facts are set forth in the following fields: welding, cutting, breaking up large masses of metal, manuf. of platinum lab. vessels and silica ware, production of rubies and sapphires, miscellaneous uses. 2 photographs and 2 drawings.

E. G. R. ARDAGH

Restoration of ancient bronzes. COLIN G. FINK AND C. H. ELDRIDGE. *Metropol. Mus. (N. Y.) Report* 1925.—An electrolytic method was developed using 2% NaOH soln. as electrolyte. The bronze to be treated is made cathode and feeble currents are employed. Basic carbonates and oxides in the crust are slowly reduced in place.

C. G. F.

Storage batteries. G. W. VINAL. *J. Optical Soc.* **11**, 263–74 (1925).—A summary of the characteristics and the operation of storage batteries, and a discussion of factors affecting capacity, characteristics of charging and discharging, resistance, efficiency, and the source of trouble. Both Pb-acid and Ni-Fe alk. cells are described. The internal resistance of the alk. cell is greater than that of the acid cell and it increases rapidly as the end of the charge is approached.

W. H. BOYNTON

The production of fluorescence and phosphorescence by radiation from the carbon arc lamp. W. S. ANDREWS. *Gen. Elec. Rev.* **28**, 659 (1925).—A simple app. for producing fine fluorescent effects is described. A C-arc of 5–6 amp., when its light is screened through red-purple ultra glass, will produce fluorescent effects in such compds. as vaseline, anthracene, rhodamin KY, synthetic dyes, uranium glass, Pt Ba cyanide; the sulfides of Zn, Ba, Sr and Ca; and in various solns. put up in clear-glass bottles.

A. D. SPILLMAN

Modern (tungsten) lamp making. C. W. MAEDJE. *Nat. Elec. Light Assoc. Bull.* **12**, 666 (1925).—A review

Theory and design of ballast resistors. H. A. JONES. *Gen. Elec. Rev.* **28**, 650–9 (1925).—A mathematical discussion of the heat losses from a single co-axial filament and a looped wire ballast operating in H gas. The article includes radiation and conduction losses, Langmuir's film theory of convection, thermal conduction, nomograms for use in designing ballast resistors, etc.

A. D. SPILLMAN

The manufacture and uses of stellite (LOSEE) 9. Chemistry of the Hybinette Ni-refining process (LATHE) 9. Tungsten (FINK) 9. Electric furnace (U. S. pat. 1,555,401) 19.

Storage batteries. W. KNOBLOCK. U. S. 1,554,823–4, Sept. 22. Structural features.

Storage battery. J. SATO. U. S. 1,555,438, Sept. 29. A paste for battery manuf. comprises an initial mixt. of PbO 88–90, C 7, asbestos 3–5 parts and H_2SO_4 which when given a forming charge in a H_2SO_4 bath of about 1.125 sp. gr. is converted into spongy Pb intermixed with asbestos, C and H_2SO_4 .

Storage battery. W. E. HOLLAND. U. S. 1,554,727, Sept. 22. Structural features.

Storage battery. F. J. WEST. U. S. 1,555,046, Sept. 29. Structural features.

Separator for storage batteries. F. W. DANE. U. S. 1,549,748, Aug. 18. Structural features.

Storage battery grids. W. H. CRISSEY. U. S. 1,550,347, Aug. 18. Structural features.

Grid plates of storage batteries. H. KELLER. U. S. 1,555,012, Sept. 29. Structural features.

Storage battery with specific gravity testing device. O. R. BLATTER. U. S. 1,553,742, Sept. 15. Structural features.

Electric battery. M. VERRON. U. S. 1,550,188, Aug. 18. Structural features of dry batteries.

Dry battery. S. APOSTOLOFF. U. S. 1,552,414, Sept. 8. Structural features.

Dry batteries. MANNESMANN-MOTOREN-WERKE. Brit. 231,135, March 24, 1924. Structural features.

Dry batteries. S. APOSTOLOFF. U. S. 1,553,658–9, Sept. 15. Structural features.

Hermetically sealed dry battery. R. C. BENNER. U. S. 1,549,851, Aug. 18. Production of gas is inhibited by use of $BaCl_2$ or equiv. material in contact with active material of the cell.

Depolarizing mixtures for batteries. G. W. HEISE. U. S. 1,553,530, Sept. 15.

MnO₂ and conductive C are combined in different ratios in different batches which are then separately milled and mixed. Cf. *C. A.* **18**, 1247.

Depolarizer material for batteries. G. W. HEISE and R. C. BENNER. U. S. 1,552,851, Sept. 8. Perforated containers for depolarizing material are treated with S, (NH₄)₂SO₄ or other material innocuous in the electrolyte in order to close the perforations and prevent sifting out of the depolarizing material.

Powder impermeable to liquids for use as a depolarizing material in batteries. R. OPPENHEIM. U. S. 1,552,871, Sept. 8. Porous grains which may be formed of wood charcoal are coated with a pectinized coagulum such as fecula, silica gel, glue or Zn oleomargarate forming a film-like layer on the grains and protecting them against penetration by liquid while permitting free penetration by gases. Cf. *C. A.* **19**, 2606.

Electric smelting furnace. B. G. KLUGH. U. S. 1,554,736, Sept. 22.

Tilting electric furnace. AKT.-GES. BROWN, BOVERI, ET. CIE. Brit. 232,224, April 14, 1924.

Tilting electric furnaces. L. D. KAY. U. S. 1,553,618-9, Sept. 15.

Electric tilting furnace. J. H. GRAY. U. S. 1,554,002, Sept. 15.

Electric furnace of the crucible type. C. B. FOLEY. U. S. 1,551,212, Oct. 6.

Electric resistance furnace. J. YOUNG. U. S. 1,555,542, Sept. 23.

Electric resistance furnace. R. E. HELLMUND. U. S. 1,553,379, Sept. 15.

Electric resistance furnaces. A. D. KEENE. U. S. 1,555,292-3, Sept. 29.

Electric resistance furnace. B. M. S. KALLING. Brit. 231,090, Oct. 6, 1924.

High-frequency dielectric furnace. C. T. ALLCUTT. U. S. 1,555,258, Sept. 29. The furnace is adapted for heating material in a crucible.

High-frequency-corona-discharge furnace adapted for heating material in a crucible.

C. T. ALLCUTT. U. S. 1,555,259, Sept. 29.

Electric arc furnace adapted for gas reactions. E. EGENAES and O. SANDVOLD. U. S. 1,554,075, Sept. 15. H₂O used for cooling one of the electrodes is introduced into a boiler into which gases heated by the arc are discharged.

Electrolytic recovery of zinc. H. W. GEPP, H. HEY, G. RIGG, R. H. STEVENS and R. T. D. WILLIAMS. U. S. 1,555,567, Sept. 29. Ore, tailings or similar Zn-bearing material is roasted, leached with an acid soln., the soln. is sepd. and the residue mixed with H₂SO₄ and furnaceed in the presence of SO₂ to solubilize its Zn content. The dissolved Zn is recovered electrolytically.

Zinc from sulfide. E. W. HALE and C. G. FINK. U. S. 1,554,575, Sept. 22. Br dissolved in a soln. of ZnBr₂ or other suitable salt which acts as a solubilizing agent for the Br is used for dissolving Zn from ZnS, the Zn is partially deposited by electrolysis and the electrolytic action is discontinued while the Br liberated remains in soln., the resulting soln. of Br and bromide being used for further treatment of additional ZnS.

Electrodeposition of iron. FRR SOC. ANON. Brit. 231,179, March 24, 1924. Electrolyte is circulated through parallel troughs (each contg. a rotating cathode) and, in a circulating system, may be treated with air or O with or without steam or may be oxidized by electrolysis with insol. anodes and treated with Fe turnings to neutralize acidity and sep. mud.

Electrodeposition of cadmium and zinc as rustproofing coatings. C. J. WERNLUND. U. S. 1,556,271, Oct. 6. Cd and Zn are deposited from a soln. of their salts, e. g., a soln. formed from Zn cyanide and Ca(OH)₂, in an aq. soln. with NaCN and NaOH. U. S. 1,556,272 specifies the addn. of a Hg compd. such as HgO to the same electrolyte so that Hg is included in the deposited coating metal.

Metal alloy electrodes for use in copper deposition, etc. CHILE EXPLORATION COMPANY. Brit. 212,871, Mar. 16, 1923. Electrodes adapted for use as insol. anodes in Cu deposition and resistant to anodic disintegration are preferably formed of Si 23-27, Fe 7-9, Pb 1.9-2.5, Sn 1-2 and Cu 60-65 parts. The electrodes may be activated, before use, to reduce their operating voltage, by using them for 20-30 hrs. as anodes in a cell contg. a weak CuSO₄ or acid soln.

Electrolytic production of aluminium. F. C. FRARY. Brit. 232,189, April 10, 1924. See U. S. 1,534,031 (*C. A.* **19**, 1667).

Melting aluminium, magnesium and similar light metals. T. METZGER. U. S. 1,552,865, Sept. 8. In melting Al, Mg and like metals in an elec. induction furnace, the furnace space above the molten charge is filled with inert gas under pressure to produce a total pressure which will eliminate or minimize the pinch effect in the melt.

Nickel anode. N. V. HYBNETTE. U. S. 1,552,609, Sept. 8. At least 0.1% of O is present in Ni anodes used for producing malleable electrolytic Ni and serves to increase soly. of the metal. U. S. 1,552,610 specifies producing Ni anodes by oxidizing a Ni bath, e. g., in a reverberatory furnace, deoxidizing the oxidized bath with a de-

oxidizer (such as Al) which forms a non-gaseous oxide (the deoxidation being insufficient to render the metal tough and malleable) and casting the deoxidized metal.

Iron oxides. C. MONNET. Brit. 230,910, Dec. 18, 1923. $\text{Fe}(\text{OH})_2$ is made by electrolyzing an alkali or alk. earth or other neutral salt with an Fe anode and a platinumized C cathode and reacting the ferrous salt and the base either within or outside the cell to form the $\text{Fe}(\text{OH})_2$. The latter is dried and calcined with regulated supply of O to produce the desired oxide.

Reduction of organic compounds with sodium amalgam combined with electrolytic caustic soda production. G. POMA and G. PELLEGRINI. U. S. 1,553,473, Sept. 15. A soln. of an alkali metal salt such as NaCl is continuously electrolyzed in contact with a Hg cathode, so that a Hg amalgam of alkali metal is formed, this amalgam is continuously brought into contact with H_2O to form caustic alkali and into contact with an org. compd. such as PhNO_2 to be reduced, and the Hg is returned to the electrolytic cell.

Carbon disulfide. P. SIEDLER. U. S. 1,549,812, Aug. 18. An elec. current is passed longitudinally through a column of charcoal or other carbonaceous material and S is introduced near one end of the column and the vapors are passed through the column longitudinally and withdrawn from near its other end.

Reactions between gases and liquids electrically induced. S. RUBEN. U. S. 1,554,296, Sept. 22. In promoting reactions between H and cottonseed oil or between other gaseous fluids and liquids having a higher dielec. const. than the gas, an elec. field is maintained through the dielec. liquid and the gas is discharged into close contact with the liquid within the elec. field. An app. is described.

Apparatus for electric purification of gases. H. EDLER. U. S. 1,549,753, Aug. 18.

Apparatus for electric precipitation of suspended particles from gases. E. OPPEN. Brit. 231,786, Dec. 18, 1924.

Electrolytic cell for producing hydrogen and oxygen from water. W. G. ALLAN. U. S. 1,552,812, Sept. 8.

Apparatus for producing oxygen and hydrogen by electrolysis of water. E. G. LUENING. U. S. 1,555,424, Sept. 29.

Apparatus for separating water and impurities from hydrocarbons, soaps, fats, etc., by electric treatment. M. S. SKAER. U. S. 1,555,231, Sept. 29. The app. is especially designed for sepg. salt water from petroleum.

Material for electric condensers. W. J. COLE, S. G. BROWN and TELEGRAPH CONDENSER CO., LTD. Brit. 230,978, Feb. 28, 1924. A dielectric for elec. condensers is formed of compensating materials having positive and negative temp. coeffs., e. g., of paraffin mixed with 3-5% of gum damar.

Cadmium electroplating. C. J. WERNLUND. U. S. 1,555,537, Sept. 29. In rust-proofing steel airplane parts or other articles by electroplating with Cd from a cyanide bath, the deposition of the Cd is effected in the presence of Hg to produce a Cd coating alloyed with a small proportion of Hg.

Electroplating apparatus. W. F. HALL. U. S. 1,555,468, Sept. 29.

Tumbling apparatus for use in electroplating. F. T. TAYLOR. U. S. 1,555,891, Oct. 6.

Apparatus for electroplating annular objects such as wheel rims. W. W. BENNER. U. S. 1,554,168, Sept. 15.

Anode for electroplating. H. G. RICE. U. S. 1,552,952, Sept. 8. Structural features.

Apparatus for electroplating wires or strips. J. A. PARKER. Brit. 231,997, March 6, 1924.

Polishing-pad and anode for electroplating. P. J. F. BATENBURG. U. S. 1,552,591, Sept. 8.

Agitating device for electrodepositing apparatus. W. W. McCORD. U. S. 1,552,938, Sept. 8.

5—PHOTOGRAPHY

C. E. K. MEES

Relation between time and intensity in photographic exposure. II. L. A. JONES AND E. HUSE. *J. Opt. Soc. Am.* 11, 319-40 (1925).—Previously published results showed that conclusively that (a) there was a definite failure of the reciprocity law, (b) the Schwarzschild equation $E = I t^p$ would not fit the observed values, and (c) the exptl. detn. of the value of "optimal" intensity was subject to great uncertainty due

to the flatness of a large portion of the P -log E curves. Results from further work on Seag 30 and Seed Graflex plates, and Eastman motion picture negative film bear out substantially those previously reported. An attempt was made to interpret the failure of the reciprocity law in terms of the Kron equation, i. e., $N = I.t.10^{-a}[(\log I/I_0)^2 + 1]^{1/2}$. This formula when applied to some of these exptl. data gives very satisfactory agreement. In the case of one of the materials investigated, Kron's formula could not be applied with the same certainty as with the others, since in making the exposures, sufficiently high values of intensity to make possible the definite detn. of log I_0 were not used. E. HUSE

Exposure and development of printing-out paper. E. STENGER. *Camera (Luzern)* 3, 271-3; 4, 11-3, 39-42(1925).—Printing-out papers may be given a short exposure and physically developed. Various tones are thus obtained without the use of noble metals. The developed prints are more permanent than those made by the printing-out process and toned with noble metals. The physical developer soln. contains no sol. Ag salts, since use is made of those present in the paper. Formulas are given.

MERRILL W. SEYMOUR

Extra-sensitized bromide papers. K. JACOBSON. *Brit. J. Phot.* 72, 513(1925).—Bromide papers sensitized with a 1:1,000,000 soln. of erythrosin contg. 2 drops of NH_4OH to 3.5 oz. of sensitizing soln. require 25-50% the exposure of an untreated paper. By using pinakryptol green, development may be conducted in the ordinary bright light. Sensitizing with pinachrome raises the sensitiveness as much as 8-15 times and it is thus possible to use papers in some cases as a substitute for plates. G. E. M.

Daylight printing with mercury. A. STEIGMANN. *Brit. J. Phot.* 72, 514(1925); cf. C. A. 19, 2306.—Papers coated with a mixt. of 8% HgCl_2 , double the quantity of 8% $(\text{NH}_4)_2\text{C}_2\text{O}_4$, and a few drops of NH_4OH , after several min. exposure to daylight followed by subsequent phys. development, yield a gray-black print simulating charcoal drawings in quality. The process is flexible and may be made to yield soft or hard results. G. E. MATTHEWS

New method of printing on gaslight paper. B. HEDLUND. *Camera (Luzern)* 3, 261-3; *Atelier Phot.* 32, 46-8(1925).—A method is described for prepg. a yellowish paper by development. A print is made in the ordinary way and developed. After development is stopped with an acetic acid bath, the print is exposed to daylight and then fixed in hypo. J. F. ROSS

Structure and composition of silver bromide gelatin plates, films and developing-out papers. J. M. EDER. *Camera (Luzern)* 4, 29-31(1925).—Statistics are given regarding the total thickness, AgBr content, grain size, etc., of various plates, films and papers. Information about the compn. and properties of film bases is also given.

M. W. SEYMOUR

Standard light-source for plate testing. ANON. *Brit. J. Phot.* 72, 518-20(1925).—Report of a committee from the Optical Soc. of America presented to the 1925 International Congress of Photography. Recommendations made are: (1) Photographic unit of intensity be defined as one visual candle power of radiation having a spectral compn. identical to that emitted by a complete radiator (black body) at a temp. of 5000°K . (2) In the detn. of speed, that the illumination incident on the photographic material shall be not less than 10, nor greater than 100 meter candles. (3) That the exposure be non-intermittent and that the variation in exposure be produced by a variation of the time factor of exposure. With materials of different color sensitivities, of ordinary color sensitivity and with pure bromide emulsions, a low-temp. source (2360°K .) does not give values which are proportional to the speeds detd. in terms of sunlight, at which the majority of photographic materials are exposed. A close approximation to that of noon sunlight, or a complete radiator operating at a temp. of 5000°K . may be obtained by the use of any one of the following filters in conjunction with a light source operating at a color temp. of 2360°K .: (1) Wratten light filter No. 79; (2) a 6-mm sheet of Macbeth daylight blue glass; (3) two cells each of 1 cm. thickness, one contg. a 3% soln. of CuSO_4 , and the other a 0.5% soln. of CuSO_4 with sufficient NH_3 completely to convert the CuSO_4 to ammoniacal CuSO_4 . The Eastman standard acetylene burner is described and tests from several laboratories show that the burner gives a value of 2360°K . Standardized incandescent elec. lamps which may be made to operate at 2360°K . can be obtained from the National Standardizing Bureaus. The photographic plate fails to integrate intermittent exposures, and therefore plate speeds should be measured with a non-intermittent sensitometer and it is much more convenient to vary the time factor than the intensity factor. G. E. MATTHEWS

Selenium toning on silver bromide papers. A. STEIGMANN. *Atelier Phot.* 32, 48-9(1925).—A method is given for changing the color of a Se-toned print or trans-

parency. The Ag selenide image is placed in a bleach bath contg. KI, KBr and $\text{KF}_3\text{e}(\text{CN})_6$. The Ag selenide is converted into AgI and yellowish red Se iodide. The Ag halide is then reduced with light or removed by fixing. Tone gradations are obtained by varying the length of time the Ag selenide image is left in the iodide bleach bath.

J. F. ROSS

The history and theory of the latent image. III. LÜPPO-CRAMER. *Z. wiss. Phot.* 23, 216-26(1925); cf. *C. A.* 19, 2787.—L.-C. discusses at length, but without adducing any new exptl. evidence, the literature from 1839 to the present time on the clouding, pulverizing, or other mech. changes by the action of light, which have been observed in films contg. or consisting of AgI or AgBr.

E. R. BULLOCK

The photographic activity of methylene blue as an adsorption effect. J. EGGERT AND J. REITSTOTTER. *Kolloid-Z.*, Special No., Apr. 1, 1925, 298-305.—When AgBr-gelatin plates are washed in a soln. of methylene blue (even when the concn. is as low as $1:10^6$ or $1:10^5$) the sensitivity is decreased. AgBr adsorbs methylene blue almost quantitatively. To 50-cc. samples of a AgBr-photographic emulsion were added 10-cc. portions of methylene blue solns. whose concns. in g. per cc. were 0, 10^{-7} , 10^{-6} , 10^{-5} and 10^{-4} . When the plates were exposed and developed in the same way, the sensitivity of the plates was found to decrease with increasing concn. of methylene blue. Together with the decrease in sensitivity appears a "veil" on the negative. These effects do not appear, if the adsorbing AgBr is dissolved out with $\text{Na}_2\text{S}_2\text{O}_3$ and the image developed physically. When the concn. of methylene blue was 10^{-4} g. per cc. the developed plate was entirely black. A calcn. of the dimensions of the AgBr grains and the surface covered by a mol. of methylene blue shows that only 2.5% of the surface of the AgBr grains could have been covered. The time spent in developing does not affect the veiling effect. Whenever there are about $5 \cdot 10^3$ methylene blue mols. per grain of AgBr a rapid decrease of sensitiveness and an increase of veiling appears. Methylene blue makes the AgBr grain susceptible to development. Such grains are not further changed by light so the sensitiveness is decreased. All such grains are developed whether reached by light or not; so a veiling of the plate appears. The adsorbed dye does not prevent the light from reaching the AgBr. The presence of S in methylene blue is at least partially responsible for this action. However S-free substances, such as Janus green, have similar effects.

F. F. BROWN

Laws of development of X-ray films. R. B. WILSEY. *Radiology* 5, 237-44(1925).—Contrast is found to increase with development time to a max., and then decreases owing to the growth of fog over the lower densities. As a rule, the lower the fog, the greater is the contrast and the longer is the range of satisfactory development times. The relation between exposure and development time to give equal density of radiograph is shown graphically. The correct time of development of a used developer can be detd. by measuring the time of appearance of the image and multiplying by the Watkins factor. The use of a hardening bath between development and fixing permits development of X-ray films to be carried out at temp. up to 90°F .

R. B. W.

Platinum bath. F. FORMSTECHER. *Camera (Luzern)* 3, 268-70(1925).— K_2PtCl_4 is always used for the prepn. of Pt toning baths rather than K_2PtCl_6 , because more Pt is deposited by a given quantity of Ag from soln. in which the Pt is in the lower state of oxidation. Neutral or alk. Pt solns. tone very slowly. Acid solns. are always used. The ionization of the Pt salts is greater in the acid baths since hydrolysis is suppressed. Boric, acetic, oxalic, tartaric and especially formic acid cause premature exhaustion of the bath by deposition of metallic Pt. Baths that keep well and tone rapidly may be prepd. with H_2SO_4 , HCl, HNO_3 , H_3PO_4 , citric and lactic acids. Of these, F. considers lactic acid the best, since it does not reduce the Pt salts or attack the half tones. Prints toned by combined Au and Pt toning are apt to develop spots due to the galvanic action of the 2 metals. Attempts to revive exhausted Pt baths by means of acids should not be made. Prints should be thoroughly washed and then placed in a NaCl bath before toning in order that sol. Ag salts may not be carried over into the Pt bath.

M. W. SEYMOUR

Chemistry of the acid fixing and hardening bath. II. The precipitate from the interaction of developer with acid fixing and hardening baths. S. E. SHEPPARD AND A. BALLARD. *J. Frank Inst.* 200, 537-8(1925).—It is found that the ratio of H_2SO_4 to alumina in the ppt. formed when alkali and sulfite and developing soln. are added to an acid fixing bath depends on the final H-ion concn. of the soln. The H_2SO_4 content decreases steadily as the p_{H} increases. While it is possible that a series of basic Al sulfates is formed, there was no direct evidence in favor of this, the compn. of the ppt. varying continuously.

S. E. SHEPPARD

Solarization. T. S. PRICE. *Brit. J. Phot.* 72, 506-7(1925).—A critical account of

that part of Arens' dissertation on the interpretation of photographic reversal phenomena (*N. physik. Chem.* **114**, 338-70) that deals with reversal by the sufficient action of one kind of radiant, chem., or mech. energy. The validity of Arens' objections to the theories of Baur (1903) and Lüppo-Cramer (1911) is considered and approved; and Arens' own theory of diminished catalytic activity in consequence of a "coagulation" of the latent image (silver) nuclei with increasing exposure, is then criticized. It is shown that his expl. basis is at best ambiguous, and doubt is expressed as to the mech. possibility of the required coagulation occurring under the conditions of a solarizing exposure.

E. R. BULLOCK

Formation of Ag in Ag halides under intense illumination (KOCH, VÖGLER) **3**. Isopropyl-*p*-aminophenol [for photographic developers] (U. S. pat. 1,555,452) **10**.

Color photography. L. TOLNAY and L. KOVASZNAV. Brit. **131,717**, July 7, 1924. Special features involving the manuf. and use of 3 separable superimposed layers each sensitized for a different part of the spectrum, with interposed color screens.

Color photography (built-up films). J. F. THORNTON. Brit. **230,965**, Feb. 15, 1924.

Color photography (built-up films). J. E. THORNTON. Brit. **231,030**, May 7, 1924.

Color photography (built-up films). J. E. THORNTON. Brit. **231,058**, July 16, 1924.

Color photography (using superposed differently colored images). L. PREISS. Brit. **231,137**, March 24, 1924.

Photographic films. J. H. HASTE. Brit. **232,232**, April 14, 1924. Different layers of a laminated film are united by the use of a special coating mixt. which may comprise nitrocellulose dissolved in fusel oil or BuOH, acetone and MeOH. Cf. *C. A.* **19**, 1668.

Light-sensitive film. T. FREUNDORFER and R. FREUNDORFER. U. S. **1,552,428**, Sept. 8. An ammoniacal shellac soln. and a sol. dichromate are used to form coatings for making etched photo-mechanical printing plates, etc.

Photographic sensitizers. M. MARTINEZ. Brit. **232,307**, Jan. 9, 1924. $\text{Hg}(\text{CN})_2$ or a mixt. of a Hg salt and a cyanide is employed in a photographically sensitive surface which may also include alkali oxalates, with or without a bromide, or tartrates, chloral, alkali chlorides, ferric salts and AgNO_3 , an albumin or gelatin size, small quantities of oxalic, tartaric or acetic acids, Na sulfite or phosphate, SnCl_4 or NH_3 . To increase the speed there may be added basic Hg cyanide, fluorescein or its Na salt, a halogen acid, a thiocyanate, formic acid or a formate, MeOH, EtOH, acetone and "suitable sizes and colloids."

Photographic reversal process. L. J. G. VAN EWIJK and H. J. PRINS. Brit. **231,246**, Jan. 2, 1924. The process of producing reversed images from developed but unfixed Ag images by removing the developed image, exposing a second time to light, and re-developing, is modified by making the second exposure to light before the primary negative image is removed.

Photographic reversal process. J. G. CAPSTAFF. U. S. **1,552,791**, Sept. 8. A Ag image is removed, *e. g.*, by KMnO_4 and H_2SO_4 soln., leaving an image of Ag salts which is then retransformed into a permanent visual image, *e. g.*, by an ordinary developer. Some of the Ag salts are removed before the transformation is complete, by the action of $\text{Na}_2\text{S}_2\text{O}_3$ soln.

Projection screens. W. G. MORSE. Brit. **232,237**, April 10, 1924. Cloth screens may be coated with a mixt. of MgCO_3 , linseed oil, turpentine and white driers, with or without other ingredients.

6—INORGANIC CHEMISTRY

A. R. MIDDLETON

Complexes of quinquevalent molybdenum. G. SCAGLIARINI. *Atti. accad. Lincei* [6], **1**, 676-9 (1925).—S. and Tartarini (*C. A.* **17**, 2400; **18**, 362, 1251) found that complexes of trivalent metals (including those of Mo^{III} with HCNS) resist hydrolysis. The complexes of Mo^{V} are easily hydrolyzed. The decomposition is indicated by color changes when the free acid is insufficient to prevent hydrolysis. Barbieri (*C. A.* **14**, 906) studied the complexes of Mo^{V} with HCNS and showed that the Braun reaction depends upon a successive hydrolysis. Klason's salt (I), $(\text{NH}_4)_2\text{MoOCl}_4$, studied by

Mauro and Danesi and by Friedheim and Euler (*Ber.* 28, 2061) is emerald-green when dry, but with H_2O this color disappears and the solns. vary from dark brown, brick-red bright red, orange or yellow, in color depending on the diln. and the degree of successive hydrolysis. The products are too sol. to be crystd. In hydrolyzing this compd. it may behave either as a double salt or as a complex salt; in fact the products of the 2 schemes of hydrolysis are in equil. A pyridine acetate soln. slightly acid with AcOH added to a cold satd. soln. of I ppts. in the course of 2 days brick-red crystals of *molybdenyl pyridine chloride*, $MoOCl_3 \cdot C_5H_5N$, in which I has hydrolyzed giving NH_4Cl and $MoOCl_3$, of which the latter is fixed by C_5H_5N . Ten g. I in 50 cc. EtOH + 15 cc. H_2O were filtered and treated with a satd. H_2O soln. of 5 g. hexamethylenetetramine contg. 2 cc. HCl and 10 g. EtOH. A dark red cryst. ppt. is obtained of a double salt, $[(NH_4)_2(Mo^{(OH)_4})] \cdot C_6H_{12}N_4 \cdot HCl$, or $2(MoO_2Cl) \cdot 4NH_4Cl \cdot 4H_2O \cdot C_6H_{12}N_4 \cdot HCl$, which is formed from the product of the other type of hydrolysis in which $(NH_4)_2Mo(OH)_4Cl_3$ is the intermediate product in question. The 2nd formula for this salt is similar to that of an oxalate, $(MoO_2)_2C_2O_4 \cdot 2(NH_4)_2C_2O_4 \cdot 2H_2O$ obtained by B. (*loc. cit.*). E. J. WITZEMANN

Alkyl compounds of thallium. ERICH KRAUSE AND ARISTID V. GROSSE. *Ber.* 58B, 1933-9(1925).—The following new compds. were prepd.: *n*-dibutylthalllic chloride, bromide, iodide, fluoride, nitrate, sulfate; diisobutylthalllic chloride, nitrate; diisooamylthalllic fluoride, chloride; diisopropylthalllic chloride, nitrate; sec-dibutylthalllic chloride, nitrate; dicyclohexylthalllic chloride, nitrate. The general method of prepn. is to add a small excess of alkyl Mg halide, drop by drop, to an ether soln. of thalllic halide.

R. J. HAVIGHURST

Interaction of nitrogen sulfide and sulfur: Nitrogen persulfide. F. L. USHER. *J. Chem. Soc.* 127, 730-5(1925).—Sublimation of N sulfide contg. free S over silver gauze at about 125° yields a film of a ruby-red compd. which turns deep blue on keeping ($\frac{1}{2}$ hr.-2 days) or on warming at 50°, and behaves like blue N sulfide (Burt, *C. A.* 4, 2419). N sulfide free from S yields directly the blue compd. from which the ruby compd. could never be obtained. These modifications are considered to be produced from different intermediate volatile N sulfides, the one giving rise to the ruby compd. being formed by the decompn. of *nitrogen persulfide*, NS_2 , by Ag. NS_2 is obtained as a dark red liquid, resembling Br, and solidifying to a pale yellow solid at the temp. of solid CO_2 , by subliming N sulfide with S at 125° in the absence of Ag gauze. It has a penetrating odor like that of I and can be distd. unchanged in a vacuum. At the ordinary temp. it decomposes slowly into S and yellow N sulfide. Water decomposes it into NH_4 salts and free S. It is more volatile than the sulfide N_4S_4 ; H_2S decolorizes an ethereal soln. with probable formation of a thio acid of N.

B. C. A.

The arsenates of trivalent manganese. I. EUGEN DEISS. *Z. anorg. allgem. Chem.* 145, 365-77(1925).—The violet manganiarsenate soln. of Barreswil (*Compt. rend.* 44, 677(1857)) is shown to possess its coloring because of the presence of triarsenatomanganic acid $[Mn(AsO_4)_3]H_4 + 3H_2O$. This compd. may be prepd. by addn. of manganic acetate, manganic hydroxide, or Christensen's "manganic acetate soln." to cold concd. arsenic acid soln. It may also be prepd. by adding a soln. of manganous acetate in arsenic acid to a soln. of $KMnO_4$ in arsenic acid. Triarsenatomanganic acid forms violet-red crystals, whose properties are described. The brown "manganic acetate soln." of Christensen (*J. prakt. Chem.* 28, 16(1883)) shows properties different from cryst. bright-red mang. nic acetate, indicating that the latter has undergone a change in Christensen's soln.

R. J. HAVIGHURST

Asymmetrical derivatives of boron. J. BÖSEKEN AND J. A. MIJS. *Rec. trav. chim.* 44, 758-62(1925).—In a previous paper B. has shown (*C. A.* 17, 2803) that in the B complexes of salicylic acid, pyrocatechol, etc., the B may be considered to have a coordination no. of 4 and to constitute the bond that joins 2 rings placed one above the other. This would permit of the existence of asymmetric compds. From the strychnine salt of disalicyloboric acid a fraction was sepd. having a higher rotatory power than the rest (Meulenhoff and B., *C. A.* 18, 1998). Other instances were sought among the derivs. of pyrocatechol since the latter itself does not show the effect. 1,2,4-Chloropyrocatechol-boric acid (I) and its cryst. K , NH_4 , $PhNH_2$, $p-ClC_6H_4NH_2$, $p-IC_6H_4NH_2$ and $o-MeC_6H_4NH_2$ salts were prepd. Equimol. amts. of I and brucine were dissolved in 86% EtOH. On evapg., needles contg. 6 mols. of H_2O of crystn. were obtained. Several fractions were obtained with about the same rotation. The brucine salt was then prepd. quickly and dried over P_2O_5 and dissolved in dry $CHCl_3$. The soln. was fractionally pptd. with ligroin. Six fractions with $[\alpha]_D$ ranging from -5.9° to -19.7° ($[\alpha]_D$ for racemic form -13.7°) were obtained. Probably $[\alpha]_D$ for the pure *d* - *l'* salt is less than -5.9° and may be positive. The last fraction contained an excess of the

l-l' form. Meulenhoff (*C. A.* 19, 2178) obtained 1,2,3- and 1,2,4-nitropyrocatechol (II and III) but better results are obtained by Dakin's method (*C. A.* 4, 1156) slightly modified (yield 25% II and 45% III). II is more sol. and was converted into 1,2,3-nitropyrocatechol-boric acid and the $PhNH_2$, $p-ClC_6H_4NH_2$, *brucine*, *strychnine*, *quinine*, *cinchonine* and *cinchonidine* salts. The dry strychnine salt in dry $CHCl_3$ was pptd. in 7 fractions with dry ligroin having $[\alpha]_D -68.7^\circ$ to -55.2° . After 8 days these showed $[\alpha]_D -60.4^\circ$ to -58.3° . The 1st fraction was extd. some days with dry ligroin + a little dry $CHCl_3$ and then showed -71.7° ; the *l-l'* isomer is less sol. and is concd. in the 1st fractions. The last fraction is richest in the *d-l'*-isomer. E. J. W.

The reactivity of silver with oxygen. N. PARRAVANO AND G. MALQUORI. *Atti accad. Lincei* [6], 1, 622-6(1925).—By the method described in a previous paper (*Atti accad. Lincei* [6], 1, 417(1925)) P. and M. detd. the capacity of mol. O_2 to oxidize Ag by heating Ag prepd. in various ways in an O medium. Four specimens were used: (1) fine Ag powder obtained by pptg. $Ag_2O \cdot NH_4OH$ soln. with glucose in the cold; (2) coarser Ag powder pptd. from the same soln. with $NaHSO_3$; (3) dendritic Ag crystals prepd. electrolytically; (4) Ag in a compact mass. 15.3 g. of each was played in a hard-glass bulb in contact with 93 cc. O at 675 mm. The temp. was raised 1° in 10 secs. up to 400° . (3) and (4) were inert to O; (1) absorbed O definitely at 130° while (2) did so at 250° . At 300° all O absorbed had been expelled again, which makes it doubtful if it was combined as Ag_2O . The finely divided state of the metal suppresses part of the passive resistance that opposes oxidation but the temp. was raised so rapidly that it was not detd. whether or not a reaction temp. corresponds to an equil. state. When the 4 specimens were heated for 5 hrs. at 156° , 193° , 213° , 230° and 250° resp., the greatest O absorption occurred at 193° and 213° for (1) and (2). (3) and (4) failed to absorb O. The velocity of absorption was different for (1) and (2) and increases up to 213° . E. J. WITZEMANN.

The interaction of sodium chloride and alumina. F. H. CLEWS. *J. Chem. Soc.* 127, 735-9(1925).—At temps. of 830 – 1050° and in the presence of moist air the following 3 reactions were observed. (A) $4xNaCl + yAl_2O_3 + xO_2 = 2xNa_2O \cdot yAl_2O_3 + 2xCl_2$; (B) $2xNaCl + yAl_2O_3 + xH_2O = xNa_2O \cdot yAl_2O_3 + 2xHCl$; (C) $4HCl + O_2 = 2H_2O + 2Cl_2$. Reaction (B) predominates, the evidence being that the Cl formed is due more to (C) than to (A). By using atms. of H_2O + HCl attempts were made to det. equil. conditions for (B), but no quant. relation could be found between the compn. of the solid and gaseous phases. It appears that for complete reaction of NaCl with Al_2O_3 in the presence of H_2O an excess of Al_2O_3 is of greater importance than one of H_2O . The stability of Na aluminate with reference to HCl decreases rapidly from 1045° , at which temp. the mol. ratio of Al_2O_3/Na_2O becomes less than 10/1, to 830° , at which temp. it is less than 12/1. WM. B. PLUMMER

Equilibrium in systems of the type $Al_2(SO_4)_3 \cdot M^{II}SO_4 \cdot H_2O$. I. Aluminium sulfate-copper sulfate-water, and aluminium sulfate-manganese sulfate-water, at 30° . R. M. CAVEN AND T. C. MITCHELL. *J. Chem. Soc.* 127, 527-31(1925).—Equil. diagrams for the above 2 systems are given. No double salt is formed between $Al_2(SO_4)_3$ and $CuSO_4$, but in the 2nd system the double salt $Al_2(SO_4)_3 \cdot M^{II}SO_4 \cdot 22H_2O$ is formed as a solid phase consisting of fine needles having the property of "knotting up into masses not unlike tapioca." This salt is presumably the same as the naturally occurring apjohnite. WM. B. PLUMMER

Decolorization of carbon disulfide solutions of iodine by red phosphorus. R. N. TRAXLER AND F. E. E. GERMANN. *J. Phys. Chem.* 29, 1119-24(1925).—The decolorization observed by Sestini (*Gazz. chim. ital.* 1, 323(1871)), was not due to adsorption but to reaction between P and I. Except with extremely dry reagents, the PI_3 formed was partly hydrolyzed to HI and H_3PO_3 which, being insol. in CS_2 , were both pptd. on the excess P. Repeated exposures to CS_2 solns. of I_2 of a sample of red P, purified in various ways to remove yellow P, decreased its wt. uniformly 18.5%, leaving an inactive reddish-violet P, which may be a new modification. PI_3 obtained from I_2 and red or yellow P in CS_2 m. 55° , though pure PI_3 m. 61° . The lower m. p. was ascribed to some S compd., probably $P_4S_3I_6$, m. 119.5° . By using CS_2 freshly purified from S by Hg, a convenient prepn. of PI_3 results. A. W. FRANCIS

The so-called suboxide of lead. A. F. VAN ARKEL. *Rec. trav. chim.* 44, 652-4(1925).—So-called suboxide of Pb prepd. by Pelouze (Guttersohp, *C. A.* 18, 2946) obtained by careful decompn. of PbC_2O_4 was investigated by the X-ray method and found to be a mixt. of Pb and red oxide (tetragonal). E. J. WITZEMANN

Application to chromium of a general method for synthesis of fluorides and silicates. A. DUBOIN. *Compt. rend.* 181, 336-7(1925).— $CrF_3 \cdot 3KPF_6$ was made when to fused KHF_2 was added gradually Cr_2O_3 or CrF_3 , and after heating to redness, SiO_2 . In some expts.

this melt was heated further with KCl 48 hrs.* The SiO_2 was recovered as tridymite, d. 2.32. The $\text{CrF}_3 \cdot 3\text{KF}$, d. 2.93, was sol. in HCl and HNO_3 . It was dissolved for analysis in HCl and the *F* detd. as CaF_2 . A. W. FRANCIS

Investigation of hypochlorous acid and the alkali hypochlorites. R. DIETZEL AND F. SCHLEMMER. *Z. anorg. allgem. Chem.* **145**, 381-93(1925).—The course of the reaction $2\text{NaOH} + \text{Cl}_2 \rightarrow \text{NaOCl} + \text{NaCl} + \text{H}_2\text{O}$ was investigated by titrimetric methods and by an ultra-violet spectrographic method. On the assumption that the above equation is correct, a molar concn. of Cl_2 in NaOH should produce a molar NaOCl soln. Titrations with thiosulfate, arsenious acid, and AgNO_3 all failed to give the expected yield of chlorite and chloride ion. In the most favorable cases, a 0.5 *M* soln. of hypochlorite was obtained. The conclusion is that a part of the Cl is bound in such a way that it is inaccessible to ordinary titrating agents. The ultra-violet spectrograph failed to locate the rest of the Cl. Hypochlorite solns. of less than 0.5 *M* concn. are quite stable if kept under proper conditions. If the hypochlorite soln. contains an excess of free Cl_2 or HClO , there is a rapid change according to the equation $\text{ClO}^- + 2\text{HClO} \rightarrow \text{ClO}_3^- + 2\text{H}^+ + 2\text{Cl}^-$. Small amts. of free acid suffice to start this reaction. R. J. HAVIGHURST

Electrolytic preparation of selenides and iodides (FISCHER) 2. Electrolytic preparation of H_2S and of metal sulfides (FISCHER) 2.

7—ANALYTICAL CHEMISTRY

WM. T. HALL

Critical studies on methods of analysis. L. A. CONGDON, A. B. GUSS AND F. A. WINTER. *Chem. News* **131**, 65-8, 81-4, 97-100, 113-7(1925).—Over 100 methods for the detn. of Zn are discussed briefly and expts. with the gravimetric detn. as ZnNH_4PO_4 , $\text{Zn}_2\text{P}_2\text{O}_7$, ZnS , ZnO and ZnSO_4 and with the volumetric detn. by means of $\text{K}_4\text{Fe}(\text{CN})_6$ show that most of the published procedures are capable of giving very satisfactory results in solns. contg. pure Zn salts. W. T. H.

The approximation method for preparing normal solutions. FRITZ PREGL. *Z. anal. Chem.* **67**, 23-7(1925).—Complete details are given for the prepn. of HCl and carbonate-free NaOH solns. which shall be exactly 0.1 *N*. W. T. H.

The use of dyestuffs in analytical chemistry. F. WM. ATTACK. *Can. Chem. Metallurgy* **9**, 201 2(1925).—The various uses of methylene blue are described. W. T. H.

Acidimetry and alkalimetry. E. ÖMAN. *Svensk Kem. Tids.* **37**, 107-15(1925).—An examn. of the limits of error including in the reckoning the dissociation of the acid. The discussion is illustrated by several titrations of 0.01 *N* solns. with errors of the order of 0.01% for macro and ± 0.0015 on 0.5 cc. (micro) vols. A. R. ROSE

Extemporaneous Fehling solution. G. PÉGURIER. *Repert. pharm.* **36**, 257-60(1925).—Three stock solns. are prepd.: (A) a filtered soln. of 150 g. tartaric acid in 450 cc. of H_2O ; (B) a soln. of 52.5 g. CuSO_4 in 250 cc. of H_2O and 10 drops of H_2SO_4 ; (C) NaOH soln. *via* French Codex. In applying the test, a mixt. of 45 cc. of A, 25 cc. of B, and sufficient C to make 150 cc. of the finished soln. is prepd. in the order named. W. O. E.

Simple method for standardizing balance weights. N. K. HARVEY. *Chem. Eng. Mining Rev.* **17**, 205-6(1925).—The method depends on the assumption that in an av. box of wts. some may be heavier and some lighter than their face value, but none will depart very much from its face value. The rider should be nearly the same wt. as the 0.01 g. wts. Assume the rider weighs exactly 0.01 g., and calc. the value of each wt. by successively comparing the wts. with one another, and the 0.01 g. wts. with the rider. Calc. the actual wt. of the rider from the formula $Ea/b = -e$, in which *E* is the calcd. difference of the largest wt. from its face value, *a* and *b* are the smallest and largest wts., resp. and *e* is the difference of the rider wt. from its face value; and recalc. the actual values of the other wts. A. PAPINEAU-COUTURE

Quantitative variations of mixtures of two homogeneous salts and a new indirect method of quantitative analysis. G. COMELLA. *Ann. chim. applicata* **15**, 123-36(1925).—Unlike numerous methods proposed in the past for detg. the components of such mixts. as $\text{NaCl} + \text{KCl}$, the new method is based on arithmetic progression and allows the independent calcn. of the components. If a soln. of definite Cl normality

centg. KCl and NaCl is titrated with AgNO_3 , a const. amt. of AgCl is pptd. regardless of the proportions of NaCl and KCl, whereas the wt. of the combined chlorides increases progressively from a soln. contg. only NaCl to one contg. only KCl. Thus 1000 cc. of N NaCl, N KCl or any N mixt. of the two gives 143.34 g. of AgCl, while the wt. of the original salt increases in arithmetic progression from 58.46 to 74.56 g. The relations are best shown graphically. Choosing the case of NaCl + KCl, the abscissa may represent the wt. of KCl in a N soln. and the no. of cc., the limits being 74.56 g. and 1000 cc., and the ordinate the wt. of NaCl in a N soln. and no. of cc., the limits being 58.46 g. and 1000 cc. A diagonal between the 2 limits (58.46 and 74.56) then represents 143.34 g. of AgCl and lines parallel to this represent lesser quantities of AgCl, *e. g.*, the line joining the 800-cc. points represents 114.672 g. of AgCl. There is an infinite no. of these diagonals, parallel to one another from the origin to the limiting amt. of AgCl, each of which represents a wt. of AgCl. A scale may be constructed on each from the ordinate to the abscissa to show the wt. of the combined chlorides, *e. g.*, the values increase from 58.46 to 74.56 on the upper diagonal. From the diagonal corresponding to the wt. of AgCl and the point on it corresponding to the wt. of the combined salts, the wt. of each of the latter is detd. by following perpendicularly and horizontally to the abscissa and ordinate resp. If the vol. of the soln. is not 1000 cc. or if the normality is not 1, the calcs. must be converted to this basis. The method is applicable in general to any mixt. of homogeneous salts, such as sulfates, carbonates, etc. As an instance of simplification, the calcs. in the case cited of NaCl + KCl may be based on the wt. of AgNO_3 instead of AgCl. Equations are derived for calcg. the wt. of NaCl and of KCl, which may be used as an alternative to the graphical method. Such equations are possible in all cases.

C. C. DAVIS

Analysis of fluosilicic acid and sodium fluosilicate. A. MAYER. *Anales soc. españ. fis. quim.* 23, 372-9(1925).—To det. H_2SiF_6 gravimetrically, dissolve 20 g. of sample in H_2O and make up to a l. To 50 cc. add a concd. soln. of KCl, and an equal amt. of alc. to ppt. K_2SiF_6 . Shake, filter on weighed paper, wash with a mixt. of equal parts alc. and H_2O , dry at 100° and weigh. To det. H_2SiF_6 volumetrically, treat 50 cc. of the above soln. with 25 cc. of cold, neutral KCl soln., add methyl orange and titrate the resulting HCl with 0.25 N alkali soln. To det. free acid in Na_2SiF_6 , moisten 3 g. of the sample with H_2O and titrate directly with 0.25 N alkali and methyl orange. To det. moisture, dry 5-10 g. at 100° and deduct the amt. of free acid. To det. insol. material, dissolve 2 g. in 200 cc. boiling H_2O , filter on a Gooch crucible, dry and weigh. Analyze Na_2SiF_6 in the same way as H_2SiF_6 , but in the case of CaSiF_6 digest with Na_2CO_3 and $(\text{NH}_4)_2\text{CO}_3$ to form insol. CaCO_3 and water-sol. Na_2SiF_6 . Filter, remove SiO_2 with $\text{Zn}(\text{NH}_4)_2\text{Cl}_2$ and ppt. CaSiF_6 with CaCl_2 , weighing as such. E. M. SYMMES

The separation of alkalis in silicate analysis. OSCAR CANTONI. *Z. anal. Chem.* 67, 33-4(1925).—The Berzelius method for detg. alkalis in silicates depends upon the decompn. of the sample with H_2SO_4 and H_2F_2 . It is usually recommended not to evap. off all of the H_2SO_4 but if the evapn. is continued and heating is carried to the decompn. temp. of $\text{Fe}_2(\text{SO}_4)_3$, then, on treating the baked mass with hot water, all of the alkali sulfate is dissolved and so little SO_4^{--} is obtained in soln. that the subsequent BaSO_4 ppt. is very small. The method is thus shortened without impairment of accuracy.

W. T. H.

The quantitative kjeldahlization of nitrates with phenolsulfuric acid and potassium sulfate. B. M. MARGOSCHES, ERWIN SCHEINOST and VIKTOR WÖYNER. *Ber.* 58B, 1850-7(1925).—If 0.2 g. of an alkali nitrate is treated with 1 g. of phenol in 20 cc. of concd. H_2SO_4 and 10 g. of K_2SO_4 and heated, the conversion of NO_3^- into NH_4HSO_4 is usually incomplete. If the K_2SO_4 is not added at the start, and the reaction is allowed to proceed in the cold for some time and the K_2SO_4 added only after heating 1 hr. or so, then the results are quant. It is possible that the losses in the former case are due to evolution of N oxides but the more probable explanation is that phenolic substitution products are first formed which cannot be converted rapidly into NH_4 salt. W. T. H.

Replacements of monatomic with polyatomic phenols in the kjeldahlization of nitrates. B. M. MARGOSCHES and ERWIN SCHEINOST. *Ber.* 58B, 1857-60(1925).—A series of expts. shows that of the di- and triatomic phenols, resorcinol and phloroglucinol are the only suitable fixing agents for nitrate N in the Kjeldahl method.

W. T. H.

The nephelometric determination of calcium and magnesium. L. KRIN. *Biochem. Z.* 158, 203-4(1925).—In the presence of NH_4 salts, Mg gives no cloud with Na sulfuricinate (C. A. 17, 3351). So Ca may be detd., nephelometrically, with this reagent by adding NH_4 salts.

F. A. CAJORI

Iodometric determination of cyanogen compounds. RUDOLF LANG. *Z. anal.*

Chem. 67, 1-15(1925).—HCN and HCNS can be changed to BrCN by treatment with aq. Br₂ and the excess Br removed by treatment with Mohr's salt in H₃PO₄ soln. or by means of hydrazine sulfate in HCl soln. The BrCN can then be titrated by means of Na₂S₂O₃ after the addn. of KI. It seems probable that some BrS₂O₃⁻ is formed as an intermediate product during the titration. It is well to use a long-necked flask to avoid loss of HCN. *To det. HCNS* add 5 cc. of sirupy H₃PO₄ to the aq. soln. of 0.5-2.0 millimols. of CNS⁻ and aq. Br₂ in excess. Add Mohr's salt till the yellow Br color disappears. Add 1 g. KI and a little starch. Titrate with thiosulfate. Instead of H₃PO₄, enough HCl can be used to make the soln. normal in acid. In this case hydrazine sulfate is a better reducing agent. *To det. HCN and HCNS*, treat with Br and analyze as above to det. HCN and HCNS. In another sample det. HCNS after removal of HCN by treatment with formaldehyde as follows: To the aq. soln. in a measuring flask, add 1 cc. of 40% formalin (enough for 5 millimols of KCN), and 5-10 cc. of AcOH. Add aq. Br₂ and decolorize with 0.05 M hydrazine sulfate soln. Add 1 g. KI and titrate with Na₂S₂O₃. *To det. IICN, HCNS and H₄Fe(CN)₆*. Ppt. ferrocyanide with Zn⁺⁺ and det. HCN and HCNS as above. In another sample det. ferrocyanide as follows: Treat the aq. soln. of the 3 water-sol. salts with an equal vol. of 0.5 N HCl and introduce K-MnO₄ until a distinct pink color is obtained. Remove the excess KMnO₄ with a little nitrite and add 2 g. urea to remove excess nitrite. After 15 min. add 1 g. KI and starch. Titrate with thiosulfate. *To det. cyanogen compds. in the presence of halides.* (1) In 1 portion of the aq. soln. det. iodide by adding 10 cc. of 6 N HCl, 1.5 g. ZnSO₄, 5 cc. 0.5 N KCN and starch. Introduce 0.5 M KNO₂ soln. until the starch iodide reaction disappears and add 4 cc. of nitrate soln. in excess. Add 3 g. of urea and after one hr. titrate ICN with Na₂S₂O₃ without further addn. of KI. (2) In another portion det. the bromide and iodide together, by treating the soln. in a measuring flask with 1.5 g. ZnSO₄, filtering and using an aliquot part of the filtrate. To this aliquot add 5 cc. of 0.5 N KCN, 5-10 cc. of sirupy H₃PO₄ and a little starch and KMnO₄ until the starch iodide reaction disappears. Add 15 cc. of N KMnO₄ in excess and decolorize after 3 min. with Mohr's salt. Add 2 drops of 0.1 N NH₄CNS soln. and 0.5 g. KBr. Titrate the ICN and BrCN with Na₂S₂O₃, adding 1 g. KI and starch toward the last. (3) In another portion det. the sum of the iodide and ferrocyanide, proceeding as in the detn. of iodide but without adding ZnSO₄ at the start. Nitrite then changes the iodide to ICN, ferrocyanide to ferricyanide and thiocyanate to HCN and sulfate. Bromide and chloride are unaffected. In the final titration with Na₂S₂O₃ add 1 g. KI and a little ZnSO₄ toward the last. (4) For the detn. of HCNS, treat the slightly alk. aq. soln. with KCNS if necessary to make the CNS⁻ content greater than that of I⁻, and 1 cc. of formalin, 5-10 cc. of AcOH and 1.5 g. ZnSO₄. Add starch and then aq. Br₂ dropwise until the starch iodide reaction disappears and a slight yellow color is imparted to the soln. Decolorize with nitrite, add 3 g. of urea and after 30 min. add 1 g. KI and titrate with Na₂S₂O₃. (5) To det. the sum of the HCNS and HCN it is necessary that the equivs. of HCN + HCNS should exceed the equivs. of HI present. Make the soln. 0.5 N in HCl, add 1.5 g. ZnSO₄, brominate and proceed as in (4). (6) The HCl content can probably be detd. directly but the suggested method has not yet been tested.

W. T. H.

Determination of oxygen and nitrogen in commercial electrolytic hydrogen. WILHELM STEUER. *Chem.-Ztg.* 49, 713(1925).—Unite 2 Hempel or Winkler gas burets by means of a transparent quartz capillary contg. a Pt wire. Heat the capillary and pass 100 cc. of the gas from one buret to the other several times until all of the O₂ has been changed to H₂O. From the contraction det. the O₂ content. Then add about 60 cc. of pure O₂ and again pass the gas mixt. through the capillary. From this contraction compute the H₂ content, allowing for the loss in H₂ during the O₂ detn. Subtract the O₂ and H₂ from the original vol., and call the difference N₂.

W. T. HALL

Determination of hydrofluoric acid. O. WÄELZEL. *Z. Nahr. Genussm.* 49, 31-7 (1925).—The method of Greeff (*C. A.* 7, 3939) by which sol. fluorides are titrated with FeCl₃ in the presence of NH₄SCN, is adapted for the analysis of disinfectants, etc.

B. C. A.

The gold content of Rhine water. F. HABER AND J. JAENICKE. *Z. anorg. allgem. Chem.* 147, 156-70(1925).—A method is described for detn. of very small quantities of Au in water, accuracy about 1.5×10^{-9} g. The method depends upon adsorbing Au on a mirror of PbS and detg. it by fire assay. Rhinewater had an av. of 3.3×10^{-9} Au and 7.1×10^{-9} Ag (g. per l.).

R. J. C. VAN DER HOEVEN

A revised titrimetric method of estimating carbon dioxide in small quantities. S. NISHI. *J. Biochem. (Japan)* 4, 473-80(1925).—The principle of the new method is to absorb the CO₂ in a NaOH soln. of known concn. and to titrate the rest of the alkali

with standard acid soln. in the presence of the bicarbonate formed, with thymolphthalein as indicator. For theoretical considerations as well as actual technic of titration consult the original. S. MORGULIS

The analysis of metallic resins. ROGER UZAC. *Chimie et industrie* 14, 186-9 (1925).—Direct titration of free acids in alc. soln. is applicable only in the case of alkali and Ca resins; but with heavy-metal salts the NaOH displaces the metal of the resin before the end point is reached. With Ca, Ba, Mg, Cu, Pb and Zn resins, the following modifications of Holde's method is recommended: dissolve 4-6 g. in benzene, filter, add 20 cc. $N H_2SO_4$, heat to boiling, sep. the layers in a sepg. funnel, wash the benzene soln. with H_2O till neutral, titrate the combined aq. soln. and washings with 0.5 N NaOH in presence of helianthin and calc. the H_2SO_4 required to decompose the soap (giving combined acids, or quantity of metal present), titrate the benzene soln. with 0.5 N NaOH in presence of sufficient alc. to prevent hydrolysis of the Na soap formed and calc. the total resin acids. Combined acids or % of metal cannot be detd. in this manner in Mn, Fe or Al resins owing to the color of the soln. which interferes with the end point and to the dual valency of Mn and Fe. Total acids are detd. as above, and the metal (or combined acids) by incineration. U. has found it most useful to report % total resin acids and "neutrality no.," i. e., ratio of combined to total acids.

The product is acid, neutral or basic according as the "neutrality no." = 1. A. P.-C.

The gravimetric determination of zinc by means of cyanamide. W. MARCKWALD AND H. GEBHARDT. *Z. anorg. allgem. Chem.* 147, 42-9 (1925).—To the nearly neutral soln. of Zn salt, add 1-2 g. of NH_4OAc for each 0.1 g. of Zn and enough NH_4OH to give an alk. reaction. Dil. to 100-700 cc. and add an excess of 5% $CNNH_2$ soln. After heating on the water bath for some time, filter off the ppt. of $ZnCN_2$, ignite and weigh as ZnO . To det. Zn in the presence of Ni, add 0.5-1 g. of NH_4CNS or NH_4OAc for each 0.1 g. of Zn and at a vol. of 100-500 cc. add an excess of $CNNH_2$ soln. and just enough NH_4OH to give an alk. reaction to litmus. Continue as above. In a similar way Cd can be detd. Directions are given for prepg. $CNNH_2$ from $CaCN_2$. W. T. H.

Potentiometric titration of gold. EDUARD ZINTL AND AUGUST RAUCH. *Z. anorg. allgem. Chem.* 147, 256-61 (1925).— $TiCl_3$ reduces trivalent Au first to the univalent state and then to metal. The end of the first reduction cannot be detd. but there is a remarkably sharp indication of the complete reduction to metal when the reaction is followed electrometrically. The $AuCl_3$ soln. should contain 4-10% HCl and it is desirable to add a little $KBrO_3$ at the start to make sure that the Au is fully oxidized but HNO_3 must be absent. In the titration with $TiCl_3$ it is easy to tell when the free Br is oxidized and the reduction of the Au begins. The electrometric titration succeeds in the presence of Hg and when Cu is present, it can also be detd. by continued titration after all the Au is reduced. W. T. HALL

Determination of copper in sulfide ores. THEODOR HECKZO. *Z. anal. Chem.* 67, 35-6 (1925).—It is recommended to roast a CuS ppt. in a porcelain crucible and to fuse the resulting oxide with 10 times as much $K_2S_2O_7$. Then, by dissolving in water and adding a little H_2SO_4 , a soln. suitable for electrolysis is easily obtained. W. T. H.

Two new, very sensitive reactions for the detection of copper. GEORG SPACU. *Z. anal. Chem.* 67, 31-2 (1925); cf. *C. A.* 18, 2300.—If a very dil. soln. of Cu^{++} is treated with a few drops of $KCNS$ and not more than 2 drops of a 2% freshly prepd. soln. of toluidine (Tldn) in alc. a very characteristic, blue, flocculent ppt. of $[CuTldn](SCN)_2$ results. This amine is insol. in water but dissolves easily in alc. If a dil. Cu soln. is treated with 2 cc. of KJ soln. and then with 3 drops of freshly prepd. 1% benzidine (Bzd) soln. in alc., a flocculent, dark blue ppt. of $[CuBzd]_2$ results. In the absence of Fe^{+++} the presence of 0.02 mg. of Cu can be detected in 10 cc. of soln. W. T. H.

A new method for separating copper and mercury. GEORG SPACU. *Z. anal. Chem.* 67, 27-31 (1925).—The proposed method depends upon the fact that Cu^{++} reacts with CNS^- in the presence of pyridine (Py) to form an insol. green ppt. of $(CuPy_2)(SCN)_2$, whereas Hg by similar treatment yields water-sol. $[HgCl_2(SCN)]^-$. To carry out the sepn. dil. the soln. to about 150 cc., heat to boiling and treat with an excess of pyridine, so that the soln. is a distinct, dark blue in color. Add NH_4CNS in excess, using 8-10 times the wt. of the original salts. Cool and after 30 min. filter and wash with water contg. a little pyridine and NH_4CNS . Ignite the Cu ppt. and weigh as CuO . Det. Hg in the filtrate by pptn. with H_2S and weighing as HgS . If the original soln. is acid, evap. nearly to dryness and dil. with water before adding the pyridine. W. T. H.

Determination of mercury in cinnabar and similar substances. E. RUPP AND

K. MÜLLER. *Z. anal. Chem.* **67**, 20-3(1925).—To the finely ground substance contg. about 0.3 g. Hg add 1 g. of KNO_3 and 5 cc. of concd. H_2SO_4 . Heat to gentle boiling with a reflux tube until the sample appears to be all dissolved. Cool, rinse into 50 cc. of water and add 1% KMnO_4 soln. until a permanent pink color is obtained. Discharge this color with a bit of FeSO_4 powder, add ferric alum indicator and titrate with 0.1 N KCNS soln. Halogen compds. must be absent. To det. Hg in HgI, therefore, ext. the material with KI soln. and make strongly alk. Filter, if necessary, and treat the KHgI_3 soln. with a little formalin and filter off the pptd. Hg. Dissolve in concd. HNO_3 , dil with water, treat with a little KMnO_4 as above to remove HNO_3 and titrate with thiocyanate. Or, if it is certain that nothing is present that will combine with I_2 , the pptd. Hg can be dissolved in a measured vol. of KI_3 soln. in the presence of AcOH and the excess titrated with $\text{Na}_2\text{S}_2\text{O}_3$. W. T. H.

The separation of selenium and tellurium. VICTOR LENHER AND C. H. KAO. *J. Am. Chem. Soc.* **47**, 2454-61(1925); cf. *C. A.* **19**, 1549.—It is possible to sep. Se from Te in HCl , tartaric, or citric acid soln. by means of hydroxylamine- HCl . Hydroxylamine sulfate is less satisfactory, giving low Se results. The conclusions of Jannasch and Muller (*Ber.* **31**, 2389(1898)) are confirmed and amplified. The use of oxalic acid with hydroxylamine hydrochloride is not so satisfactory. Both hydrazine hydrochloride and sulfate cause pptn. of Te with Se. This can be avoided in the method of Pelini (*Gazz. chim. ital.* **33**, 515(1903)) with proper control of temp. R. J. H.

Analysis of bearing metals. J. HESLINGA. *Chem. Weekblad* **22**, 409-12(1925); cf. *C. A.* **13**, 3106; **16**, 394.—The method of Oosterheld-Honeggerde Pauw was controlled. The KBrO_3 titration of Sb gives correct results; the soln. should be allowed to cool in a CO_2 atm. Considerable errors in the gravimetric Pb detn. as PbSO_4 can be avoided only by following the Standards of the Am. Soc. for Testing Materials, 1923, p. 502. Haen-Low's iodometric detn. of Cu although abandoned by O.-H. yields correct results with certain precautions: cool and filter PbSO_4 in a CO_2 atm., add KI in the form of a 10% soln., dilute liberally before adding the indicator, titrate rapidly. To det. Sn filter the soln. after the Sb oxidation and add to the whole or an aliquot part (according to the Sn content) 80 cc. concd. HCl and 3 times 3 g. granulated Zn without heating. Boil in a CO_2 atm. until the H_2 development subsides, cool rapidly, add starch soln. and titrate with 0.1 N I soln. standardized against pure Sn. At least 3 samples must be analyzed because of the inhomogeneity of the alloy. The mean result is often > 100%, the first decimal mostly uncertain. MARY JACOBSEN

Further studies on the determination of invert sugar: the iodometric methods. I. PICK. *Z. Zuckerind. cecoslov. Rep.* **49**, 251-5, 259-63(1925); *Listy Cukrov.* **43**, 185ff(1925); cf. *C. A.* **19**, 3028.—Prep. soln. I—17.32 g. pure $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ per l.; and soln. II—86.50 g. pure Rochelle salts and 33.05 g. pure anhyd. Na_2CO_3 per l. Dissolve the sample in 50 cc. (corresponding to 10, 5, 2.5, or 1 g. sucrose), add 25 cc. each of solns. I and II, and a little talc, reduce as described in the previous paper. At the end of boiling add 50 cc. H_2O carefully so as not to carry air bubbles into the soln., cool in running H_2O 3 min., add 20-25 cc. cold satd. oxalic acid soln., add standard I soln. till the flask is brown, then excess of standard $\text{Na}_2\text{S}_2\text{O}_3$ and starch, titrate back with I soln. Tables are given showing mg. Cu corresponding to given amts. of invert for the 4 amts. of sucrose. Another sample should be boiled as above with soln. II only, and any I-no. it may thus show must be subtracted from the final reading. A no. of samples were analyzed by different methods. On some samples all methods gave the same results. In some cases org. matter is included in the Cu_2O ppt.; hence any method involving weighing Cu_2O is inaccurate. In such cases the T methods of the previous paper are high, on account of the action of this org. matter on the KMnO_4 . In some cases, especially with low invert, colloidal Cu_2O may pass through the filter. Everything considered, the iodometric method is the most generally reliable, especially for low-grade products. W. L. BADGER

Determination of invert sugar in sucrose solutions with the titrimetric reduction method. M. A. H. VAN DEN HOUT, P. A. NERTESON AND A. L. VAN SCHERPENBERG. *Chem. Weekblad* **22**, 295(1925); cf. Schoorl, *C. A.* **19**, 1836.—Polemical.

A contribution to the determination of invert sugar. R. OFNER. *Z. Zuckerind. cecoslov. Rep.* **36**, 279-82(1925); cf. *C. A.* **19**, 583.—The amt. of Cu_2O pptd. by sucrose alone is a serious source of error in using the ordinary Fehling soln. on sugars contg. small amts. of invert. A modified Fehling soln. is prepd. as follows: Dissolve 8.10 g. pure anhyd. Na_2CO_3 in 100 cc. H_2O at about 60° . Dissolve 20.00 g. pure $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (best prepd. by pptg. with EtOH from aq. soln.) in 100 cc. H_2O at 60° , and add this gradually to the soda soln. Heat a few min. at 60° on a H_2O bath. Then add 240 g. pulverized neutral

Rochelle salt, shake till dissolved, heat to 60° if necessary to complete soln. Then add 80 g. "sodium phosphate," make up to 1 l. The soln. is then treated with ignited infusorial earth, filtered and stored in a dark place. It will keep unchanged for a considerable time. For white sugars take 50 cc. reagent and 50 cc. of the clarified soln. (contg. 10 g. sucrose), bring to boiling in 4-5 min., boil 5 min., cool quickly, dil. with 50 cc. of 25 vol. % EtOH; filter on a Gooch crucible, wash with EtOH of 10 vol. %, and det. Cu by any method. For raw sugars, take 76.8 cc. of the soln. used for polarizing (normal wt. in 100 cc.), add 15 cc. of a soln. contg. 100 g. Na_2HPO_4 per l. and satd. with $\text{Na}_2\text{Na}_2\text{C}_2\text{O}_4$, make up to 100 cc., mix, let stand 15 min., filter, use 50 cc. for the invert detn. as above.

W. L. BADGER

Hydrogen and oxygen electrode titrations of some dibasic acids and of dextrose. H. T. S. BRITTON. *J. Chem. Soc.* 127, 1896-917(1925).—Since it is possible to titrate with the H_2 electrode to an accuracy of about 1 millivolt, the e. m. f. curves thus obtained should serve to test the applicability of the formulas derived by Auerbach and Smolczyk (*C. A.* 19, 222) for the calcn. of ionization constns. Oxalic, malonic, succinic and tartaric acids and also dextrose were, therefore, titrated electrometrically at 18°. Formulas were derived for the calcn. of the ionization constns. which are based upon fewer arbitrary assumptions than those used by A. and S. The results indicate that the ionization constns. of oxalic acid are 0.17 and 1.3×10^{-4} ; of tartaric acid 1.3×10^{-3} and 9.7×10^{-6} ; of succinic acid 9.2×10^{-6} and 5.3×10^{-6} ; and of malonic acid 2.0×10^{-3} and 4.4×10^{-6} . If dextrose is to be regarded as a monobasic acid, its ionization const. is 5.9×10^{-13} . A. and S.'s assumption that the product of the 2 ionization constns. of a dibasic acid is equal to the square of the hydron concn. at the middle part of the titration, is proved to be erroneous. An attempt was made to use the O_2 electrode for, detg. hydron concns. but the results were somewhat erratic.

W. T. H.

The oxidimetric determination of tartaric acid and other organic substances. KURT TAUFEL AND CARL WAGNER. *Z. anal. Chem.* 67, 16-20(1925).—Dil. the original soln. so that it contains about 7.5 g. tartaric acid per l. Mix 5 cc. of this soln. with 5 cc. of $N \text{ K}_2\text{Cr}_2\text{O}_7$ soln. and add carefully 15 cc. of concd. H_2SO_4 . Heat 15 min. on the water bath to complete the reaction. After cooling, add 200 cc. of water, 10 cc. of $N \text{ KI}$ soln. and titrate with $\text{Na}_2\text{S}_2\text{O}_3$ with starch as indicator. In this way the oxidation of tartaric acid to CO_2 corresponds to 10 equivs. of O per mol. tartaric acid. The $\text{K}_2\text{Cr}_2\text{O}_7$ is added in approx. 100% excess. Treated in the same way, 1 mol. of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ unites with 8 mols. of $\text{K}_2\text{Cr}_2\text{O}_7$, 1 mol. of salicylic acid with 4.667 mols. of $\text{K}_2\text{Cr}_2\text{O}_7$, 1 mol. of phthalic acid with 5 mols. of $\text{K}_2\text{Cr}_2\text{O}_7$ and 1 mol. of β -naphthol with 7.667 mols. of $\text{K}_2\text{Cr}_2\text{O}_7$. The method is, therefore, applicable for the complete oxidation of many org. substances, although some substances such as acetic and succinic acids are scarcely oxidized at all by this treatment.

W. T. H.

A qualitative test to show the absence of citrate or tartrate in mixtures. J. B. PETERSON. *Ind. Eng. Chem.* 17, 1146(1925).—Extremely small amts. of citrates or tartrates interfere with the purple color of the ferric salicylate complex. A very delicate test based on this fact, which is particularly applicable to the analysis of medicinal mixts., is described.

E. J. C.

A new method for determining formaldehyde. GIOVANNI ROMEO. *Ann. chim. applicata* 15, 300-4(1925).—The method is based on the fact that $\text{CH}_2\text{OH}(\text{SO}_3\text{K})$ is neutral and that KHSO_3 can be titrated accurately with rosolic acid as indicator. The presence of Na_2SO_3 both accelerates the reaction and renders the KHSO_3 soln. more stable. To 1 cc. of HCHO soln. add 8 drops of 2% alc. rosolic acid, neutralize any acidity with 0.5 N aq. NaOH , add 50 cc. of a soln. contg. 60 g. of KHSO_3 and 100 g. of anhydrous Na_2SO_3 (or 200 g. of $\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$) per l., close the soln. from the air, let stand 15 min. and then titrate with 0.5 N aq. NaOH until a distinct rose color appears. Titrate 50 cc. of the same KHSO_3 - Na_2SO_3 soln. with the same 0.5 N NaOH and with the same quantity of indicator. From the difference between the no. of cc. of 0.5 N NaOH consumed in the 2 titrations, calc. the quantity of HCHO , each cc. of 0.5 N NaOH corresponding to 0.06 g. of K_2SO_3 and 0.015 g. of HCHO . For the detn. of trioxymethylene, proceed as before but use 0.30-0.40 g. and boil gently 10 min. in an open vessel. Comparative tests of the new method with the iodometric method (cf. Romijn, *Z. anal. Chem.* 36, 18(1897); 39, 60(1900)) gave 39.23 and 38.92%, resp., for 1 sample and 38.89 and 39.07% resp., for another. Samples of com. trioxymethylene gave 96-7% HCHO .

C. C. D.

Determination of chlorine in benzaldehyde and cinnamaldehyde. TH. HEINZ FAUST AND THEO. SPÄNGLER. *Chem.-Ztg.* 49, 724-5(1925).—Add 25 g. of aldehyde through a dropping funnel to a mixt. of 5 cc. fuming HNO_3 and 25 cc. concd. H_2SO_4 .

Pass the resulting SO_2 and HCl into AgNO_3 soln. and weigh the AgCl formed.

W. T. H.

Determination of chlorine in benzaldehyde. J. D. BUKSCHNEWSKI. *Z. angew. Chem.* 38, 723-4(1925).—Moisten the sides of an alloy-steel, calorimetric bomb with 5-10 cc. of water. Place 2 g. of substance in the Pt or quartz crucible and introduce 25 atm. of O_2 . Ignite as in detg. B.t.u. After 5 min. release the pressure carefully, allowing the gas to escape through AgNO_3 in dil. HNO_3 . Add the rinsings of the bomb and weigh the resulting AgCl .

W. T. H.

Determination of methanol and ethanol. JOSEF WIMMER. *Z. angew. Chem.* 38, 721-3(1925).—A simple method consists in treating the alc. with large excess of HCO_2H whereby esters are formed which boil considerably lower than the alcs. or the acid. Treat the liquid contg. alc. with HCO_2H and a little H_2SO_4 . Cause the vapors evolved on heating to pass through a fractionating column and into a Peligot tube contg. a measured vol. of standard NaOH . Titrate the excess of NaOH .

W. T. H.

Differentiation of the naphthols, and condensation product of α -naphthol with formaldehyde. A. ZAMPARO. *Boll. chim.-farm.* 64, 97-100(1925).—The 2 naphthols may be differentiated by means of their color reactions with (i) H_2SO_4 in alc. soln. contg. H_2O_2 , and (ii) CH_2O in presence of HCl . The di- α -naphthylmethane obtained by the condensation of α -naphthol in alc. soln. with CH_2O in presence of HCl readily undergoes oxidation to α -naphthyl-naphthylidene-methane (?), which is a red compd. turned blue by alkali and may be used as an indicator.

B. C. A.

The detection and determination of *p*-sulfamylbenzoic acid in saccharin and crystalline (KOLTHOFF) 2. Report of Committee XVII. Wood preservation (analysis of ZnCl_2) 20. The volcanic activity and hot springs of Lassen Peak (DAY, ALLEN) 8.

8—MINERALOGICAL AND GEOLOGICAL CHEMISTRY

EDGAR T. WHERRY

The crystal structure of some metallic sulfides. L. S. RAMSDELL. *Am. Mineral.* 10, 281-304(1925).—Crystal structure should be the criterion of isomorphism. Argentite, hessite, eucairite and naumannite are ruled out of the galena group because of dissimilar structures, while clausthalite and altaite are isomorphous with galena. The pyrite group is verified by X-ray examn., except for chloanthite and smaltite. Cinnabar has a simple rhombohedral structure and is not isomorphous with covellite. Argentite and acanthite give identical X-ray pictures. Values obtained for the radii of Se and Te from PbSe and PbTe, considering that of S to be 1.04 A. U. are 1.15 A. U. and 1.27 A. U.

C. B. SLAWSON

Tetradymite from the Hailey Quadrangle, Idaho. E. V. SHANNON. *Am. Mineral.* 10, 198-9(1925).—Analysis shows 2.17% Se, probably replacing both Te and S, the formula being otherwise normal, $\text{Bi}_2\text{S}_2\text{Te}_2$. It fails to give the blowpipe and qual. tests ascribed to Te minerals in the books.

C. B. SLAWSON

Jamesonite from Slate Creek, Custer County, Idaho. E. V. SHANNON. *Am. Mineral.* 10, 194-7(1925).—An analysis of an authentic specimen of this rare mineral is given, the formula being that of Schaller, except for a little excess Fe. Most "jamesonite" is in reality boulangerite, which is the typical needle or feather ore.

C. B. S.

Microscopic study of the α, β -transformation of native cristobalite. R. WEIL. *Compt. rend.* 180, 1949-51(1925).—The temp. of transformation ranged between 170° and 190° for certain specimens, 215° to 250° for others. Still other specimens showed both of these ranges of temp.

L. W. RIGGS

The cause of color in smoky quartz and amethyst. E. F. HOLDEN. *Am. Mineral.* 10, 203-52(1925).—The nature of the pigments of smoky quartz and amethyst was investigated from the standpoints of the occurrence and genesis of these minerals, the effect of heat and of radiations upon the colors, the transmission of light, and analysis for the various impurities. It is concluded that amethyst owes its color to a ferric compd. while smoky quartz is probably pigmented by free at. Si, liberated through the action of radioactive substances.

C. B. SLAWSON

Zircon, a contact metamorphic mineral in the Pend Oreille district, Idaho. J. L. GILLSON. *Am. Mineral.* 10, 187-94(1925).—Minute zircon crystals are abundant in the rock adjacent to a batholith. The non-calcareous rocks throughout the district carry a few larger crystals of detrital zircon, while the calcareous rocks contain none

except near the contact. The metamorphic zircon is associated with tourmaline, and is of pneumatolytic or hydrothermal origin. C. B. SLAWSON

A new theory of the composition of the zeolites. A. N. WINCHELL. *Am. Mineral.* 10, 88-97, 112-7, 145-52, 166-74(1925).—The zeolites form a number of isomorphous series, each similar to the feldspars. In any one series, variations may occur by the substitution of Na (or K) for Ca, atom for atom, so that in any series $\text{Ca} + \text{Na}$ (atoms) is a constant. Also $\text{Al}_2\text{O}_3 : \text{CaO}$ ratio is unity for all zeolites and $\text{Al} + \text{Si} : \text{O}$ is always 1:2. Natrolite, mesolite, scolecite, and stilbite are exceptions with fixed compns. Exception is also made for secondary replacement, after the formation of the crystals, when 2 Na atoms replace 1 Ca atom. C. B. SLAWSON

Pseudo-isomorphism as illustrated in thomsonite. F. T. WHERRY. *Am. Mineral.* 10, 342-7(1925).—Since the fact that analysis of a mech. mixt. will give the same results as that of an isomorphous mixt. of the same components is occasionally overlooked, it is urged that no claim of the isomorphism of 2 or more compds. should be accepted unless accompanied by optical evidence. The inadequacy of Gordon's calcns. of the formula of thomsonite (C. A. 18, 3023) is pointed out, and the usefulness of Schaller's method (C. A. 7, 1470) is shown. When applied to the 3 thomsonites, using this name in the original sense, for which analyses on optically homogeneous material are available, the latter method shows unmistakably that the formula is $\text{Na}_2\text{O} \cdot 4\text{CaO} \cdot 5\text{Al}_2\text{O}_3 \cdot 10\text{SiO}_2 \cdot 12\text{H}_2\text{O}$. This agrees with what had previously been obtained by a somewhat different procedure (C. A. 17, 2845). Winchell (preceding abstract—p. 90) plotted a series of analyses of materials which the analysts called thomsonite and considered that the results indicated the existence of an isomorphous series, on the atom-for-atom basis, 1 Ca replacing 1 Na at the same time as 1 Al replaces 1 Si. He gave no optical data, however, and examn. of over 25 specimens similar to those analyzed, by immersion in a liquid with $n = 1.518$ has demonstrated that mech. mixts. are frequently represented. The constituents are in part common zeolites, but faroelite is also at times present. Schaller's method, applied to the only analysis available of satisfactory optical homogeneity, suggests the formula of this to be $\text{Na}_2\text{O} \cdot 2\text{CaO} \cdot 3\text{Al}_2\text{O}_3 \cdot 7\text{SiO}_2 \cdot 7\text{H}_2\text{O}$, but more work on it is needed. Winchell's diagram is held to show not a continuous series, but the 2 species thomsonite and faroelite, both with more or less admixt. The chem. and optical data thus agree in indicating that the alleged thomsonite series represents only pseudo-isomorphism. E. T. W.

Gyrolite and okenite from Bombay. W. A. K. CHRISTIE. *Records Geol. Survey India* 56 (part 3), 199-203(1924).—Analyses and optical data for these two non-aluminous zeolites are given. J. F. SCHAIRER

The thermo-optical properties of heulandite. C. B. SLAWSON. *Am. Mineral.* 10, 305-31(1925).—Through the temp. range 25-300°C. heulandite shows a rotation of the optic plane and a change in optic angle while the crystal remains biaxial and +. The rapid change at 177° is correlated with the 3-mol. hydrate. Above this temp. the structure persists in a metastable condition. C. B. S.

The so-called halloysite of Jones Falls, Maryland. E. V. SHANNON. *Am. Mineral.* 10, 159-61(1920).—This mineral is shown to be identical in compn. with certain gouge clays, $\text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2 \cdot 4\text{H}_2\text{O}$. C. B. SLAWSON

Antlerite from Chuquicamata, Chile. I. F. AUDRIETH AND J. H. C. MARTENS. *Am. Mineral.* 10, 161-3(1925).—The recognition by optical examn. and chem. analysis of abundant antlerite, $3\text{CuO} \cdot \text{SO}_3 \cdot 2\text{H}_2\text{O}$, from this deposit suggests that it, instead of brochantite, may be the chief ore. C. B. SLAWSON

Geology of East Tintic. G. W. CRANE. *Trans. Am. Inst. Mining Met. Eng.* 1925, No. 1491-I, 15 pp.—The discovery of paying ore deposits in East Tintic district appears probable. I. W. RIGGS

Mineral statistics. ANON. *Mineral Ind.* 33, 818-97(1924).—Tables of production and trade for various countries. A. B.

The present status of the mineral resources of Sicily, aside from sulfur. LORENZO BUCCA. *Rass. min. met. chim.* 63, 31-3(1925).—A wide variety of minerals is available, as well as bituminous shales and petroleum. C. C. DAVIS

Mineral resources of Northern Ontario. W. A. PARKS. *J. Roy. Soc. Arts* 73, 898-917(1925).—The total metal production of Ontario to the end of 1924 is valued at over 771 million dollars. The principal metals arranged in the order of production value are Ag, Ni, Au, Fe, Cu and Co. About 9000 oz. each of Pt and Pd were produced in 1924. The outlook for future profitable mining in northern Ontario is considered favorable. I. W. RIGGS

The auriferous deposits of French Guiana. A. PERROUD. *Rass. min. met. chim.* 63, 33-5(1925).—Au occurs in stratified rock overlying gneiss, mica- and talc-schists

interposed by eruptive granite, diorite and diabase and in the alluvium of the region.* The nuggets are large (the max. so far being 15 kg.), but they are coated with an Fe oxide so that amalgamation is difficult. The alluvium, comprising a mixt. of quartz, clay and other rocks, is rich throughout in Au, its content usually being for the most part 6-10 g. of Au per cu. m., but reaching 50 g. at times. Other minerals such as granulite, bismuthinite, cassiterite, pyrite and small quantities of Mn and Zn are also present.

C. C. DAVIS

Possible inorganic petroleum. An inquiry as to quantitative adequacy. J. V. LEWIS. *Eng. Mining J.-Press* 120, 137-9(1925).—The org. origin of petroleum appears to be established but it may not be the exclusive source. The igneous magma must be regarded as a potential source of petroleum.

L. W. RIGGS

The alkaline rock region of Kuolajärvi in North Finland. VICTOR HACKMAN. *Bull. Geol. Comm. Finland* No. 72, 7-52(1925).—The chem. and mineralogical compns. of the prevailing gneiss-granite and its modifications, quartz-diorite, quartz-gabbro-diorite and quartz-gabbro, are described with reference to their genetic relations. Among the alk. rocks, cancrinite, nepheline-porphyr, ijolite, ijolite-pegmatite, nepheline-basalt and other basaltic rocks are studied in a similar manner as also are mixed rocks, limestone and its contact metamorphoses. Twenty-one chem. analyses are recorded.

L. W. RIGGS

Phosphoric acid in the "limagne" and the "cinerites" of the volcano at Auvergne. R. CHAVASTELON. *Compt. rend. agr. France* 11, 590-2(1925).—A complete chem. analysis is given of "cinerites" from various sources. They contained 0.003-0.04% P_2O_5 .

F. M. SCHERTZ

Formation of rocks and minerals. LÖSNER. *Naturwissenschaftl. Umschau* 14, 113-6(1925).—From the literature reviewed the conclusion is drawn that both limestone and gypsum originate in direct pptn. from sea water by the activity of certain organisms.

L. W. RIGGS

Disintegration of argilo-siliceous rocks in connection with the effects of climate. R. GANSEN. *Mitteilungen Lab. Preussischen Geol. Landesanstalt* 4, Berlin 1922; *Rev. internat. reueign. agr.* 3, 149-50(1925).—Equations are written for the breakdown of potash feldspar into various silicates under moist-cool, moist-warm and arid climates. G. discusses the effect exerted by the compn. of the mother rock on the disintegration, and also that of the chem. reaction of the soil which is being formed.

A. P.-C.

The volcanic activity and hot springs of Lassen Peak. A. L. DAY AND E. T. ALLEN. *Carnegie Inst. Publ.* 360(1925).—Part I. D. and A. undertook a chem. and geological study of the past and recent igneous activity of Lassen Peak. The variations in the chem. compn. of the rock types is shown graphically. A petrological and chem. study of the products of recent activity is given, with analyses. The water and gas content, ferric ratio, mineral changes on heating and flow temp. of the conduit lava were detd. It is concluded that the volcanic activity was probably due to the advent of water vapor (from meteoric waters) to the undercooled magma which increased its fluidity and consequently its reaction-rate, causing a more rapid approach toward equil. through crystn., to which corresponds an enormous increase in the vapor tension (since the water content is confined to the liquid portion of the melt) with consequences of catastrophic proportions. An extraneous cause such as the cracking or faulting of the rock in the volcanic plug may have weakened the rock structure and also allowed the advent of surface waters to ppt. the catastrophe. Part II. The hot springs of the region are described and the highest temps. in each area are close to that of boiling water for the elevation. The fact that they are a little lower presumably means that the influence of escaping gases is greater than that of dissolved salts. The waters (sulfate waters almost free from chlorides) were analyzed, and the analyses with methods used are given. Thin salt incrustations are common near the springs. Thionates are found in these incrustations and detailed qual. methods for dithionates, trithionates, tetrathionates, and pentathionates are given. Pentathionates and tetrathionates can be detd. quantitatively by treating with $Hg(CN)_2$ and ascertaining the ratio of HgS to free S in the ppt. The sulfates present in the salt incrustations are halotrichite, voltaite, aluminogen, and pickeringite. Gases from the hot springs were collected and analyzed, detailed analytical procedure being given. A full discussion of the chem. changes in progress in the springs is given. There are 2 principal processes, one leading to the formation of pyrite and the other the decompn. of the lavas by hot waters. There are 2 general types of lava decompn., one producing kaolin and some SiO_2 without Al sulfate; and the other producing SiO_2 with Al sulfate. The paper contains much chem. information too detailed to abstract.

J. F. SCHAEFER

Precious stones. G. F. KUNZ. *Mineral. Ind.* 33, 600-31(1924).—Discusses produc-

tion, trade, marketing and uses, including diamonds, rubies, emeralds, sapphires, etc. A. B.

Differentiation between mullite and sillimanite (NAVIAS, DAVEY) 19. An X-ray study of cyanite and andalusite (NORTON) 19. Crystal structure of niccolite and pyrrhotite (DE JONG) 2. Crystal structure of breithauptite (DE JONG) 2.

9—METALLURGY AND METALLOGRAPHY

D. J. DEMOREST, R. S. WILLIAMS

The Chief Consolidated volatilization process and mill. G. H. WIGTON. *Trans. Am. Inst. Mining Met. Eng.*, (preprint) No. 1490-B, 10 pp.—Ore contg. Cu, Pb, Ag and Au is concd. and then given a volatilizing roast in a rotary kiln, without salt. Very high extn. of Au, Ag and Pb results, the fume carrying 27.8% Pb and 64 oz. Ag per ton. An account of exptl. development and the present status is given, with flow-sheets. Com. operation began in May, 1925. A. BUTTS

Chloridizing mill of the Standard Reduction Co. H. P. ALLEN and WM. C. MADGE. *Trans. Am. Inst. Min. Met. Eng.*, (preprint) No. 1481-B, 22 pp.—Ore carrying 5% Pb, 0.3% Cu, 18 oz. Ag and 0.025 oz. Au per ton is crushed, mixed with NaCl and roasted in Holt-Dern furnaces. The roasted ore is leached by percolation with brine. From the soln. Ag is pptd. on sponge Cu, the Cu on scrap Fe and the Pb on additional scrap Fe, each pptn. being done in a sep. set of boxes. Details and diagrams are given. A. BUTTS

Progress in ore dressing and coal washing in 1924. R. H. RICHARDS and C. E. LOCKE. *Mineral. Ind.* 33, 759-817(1924).—Reviews new developments in crushing and grinding, screening, gravity concn., amalgamation, magnetic concn., flotation, treatment of coal and special processes, with examples of practice and bibliography. A. B.

Pulp-density indicator useful in flotation work. R. S. HANDY. *Eng. Mining J.-Press* 120, 536(1925).—The app. is an adaptation of Fahrenwald's d. bulb. Its essential points are indicated in an illustration. It is standardized occasionally by detg. the d. of actual wts. of the pulp. W. H. BOYNTON

Froth flotation explained by X-ray. C. G. McLACHLAN. *Eng. Mining J.-Press* 120, 408-9(1925).—Space-lattice diagrams of certain sulfide, oxide, and carbonate minerals are shown. These indicate that the chief difference that exists between floatable and non-floatable minerals lies in the latter having O present in their surfaces while the former have metal or S. A surface contg. O would not possess the powerful attraction for gaseous O possessed by metal or S, so that oxide minerals do not adsorb air bubbles as the sulfide minerals do. A. BUTTS

Effect of cyanogen compounds on floatability of pure sulfide minerals. E. I. TUCKER and R. E. HEAD. *Trans. Am. Inst. Mining Met. Eng.*, (preprint) No. 1487-B, 17 pp.—The floatability of PbS, ZnS and FeS₂ in distd. H₂O was tested with addition of different amts. of CaO, Na₂CO₃, NaCN, ZnSO₄ and CuSO₄, some of these being added singly and some in combination. Addn. of NaCN-ZnSO₄ mixt. greatly depressed the flotation of ZnS and gave a low floatability of FeS₂, while allowing a very high floatability of PbS, indicating its value as a reagent for differential flotation. The effect of the mixt. was studied by partial immersion of crystals of the minerals with subsequent microscopic examn. of the immersion line. A surface alteration was found, the gradation of which corresponded to the different rates of floatability obtained. Results for the other reagents tested are tabulated. A. BUTTS

A new type of flotation machine. D. L. FORRESTER. *Eng. Mining J.-Press* 120, 492(1925).—F. describes a new cell which is claimed to be foolproof, to require a min. of repairs, and a normal power need per unit of ore. Air consumption is more than that for ordinary porous media but at lower pressure. W. H. BOYNTON

Intermittent agitation and decantation. L. P. HILLS. *Eng. Mining J.-Press* 120, 378(1925).—The flow sheet of an intermittent agitation and decantation system for a cyanide plant is shown. The agitation tank, which also serves as a thickener should be as large as practicable. Its height is detd. by the settling properties of the pulp. Details of the Tuolumne agitator are given and the advantages of the system are shown to be: low first cost, no line shafts, belts or pulleys, low upkeep, low power consumption, and flexibility of operation. Additional tanks are used when the ore does not settle. W. H. BOYNTON

Ore concentration at the Old Dominion. G. J. YOUNG. *Eng. Mining J.-Pres.* 120, 536(1925).—Y. outlines the readjustment of milling practice at the Old Dominion mine at Globe, Ariz. A flowsheet is shown of the coarse crushing plant. W. H. B.

Reduction of ferric oxide and iron ores by hydrogen. HEIHACHI KAMURA. *J. Iron Steel Inst.* (advance proof), Sept., 1925, 19 pp.—Samples of pure Fe_2O_3 and of hematite were heated to temps. of 500° to 800° in a combustion tube and H was passed over them., the vol. of gas used and the percentage of reduction to Fe being recorded at definite time intervals. At 500° the time required for 90% reduction of the hematite was 78 min., at 600° 46 min., at 700° 39 min., and at 800° 30 min.; the vol. of H used also decreased with rise of temp. At about 570° the velocity of reduction increased rapidly and the vol. of H decreased suddenly, probably because reduction below this temp. was from Fe_2O_3 to Fe and above it from Fe_2O_3 to FeO and FeO to Fe. As velocity of reduction increases slowly above 600° , this would be the most economical reduction temp. A. BUTTS

Reduction of zinc oxide by carbon. G. A. ZELLER AND B. M. O'HARRA. *School of Mines and Met. Univ. Mo. Tech. Bull.* 8, 3-32.—Information concerning the temp. at which reduction begins in a Zn retort is reviewed and an account given of an investigation of the effect on the rate of reduction of temp., time and phys. characters of the ZnO and C. Weighed briquets of ZnO and C were sealed in graphite retorts and heated in an elec. furnace for the desired time of distn. At temps. above that at which reduction began the rate of reduction doubled with equal intervals of temp., the intervals varying for different forms of C. Calcined ZnCO_3 reduced much more rapidly than other forms of ZnO. Such differences are mainly due to surface conditions of the ZnO or C particles. A. BUTTS

Cadmium. C. P. LINVILLE. *Mineral Ind.* 33, 102-3(1924).—A review of production, sources and metallurgy. A. B.

The metallurgy of lead in 1924. O. C. RALSTON. *Mineral Ind.* 33, 447-59(1924).—A review of progress. A. B.

Lead. R. M. SANTMYERS. *Mineral Ind.* 33, 422-47(1924).—A review of the industry, covering market, trade, world production and Pb compds. A. B.

Lead smelting in Utah. B. I. SACKETT, CARLOS BARDWELL, SIMON JACOBSON AND N. H. JENSEN. *Trans. Am. Inst. Mining Met. Eng.* (preprint) No. 1486-D, 27 pp.—An account of practice consisting of pre-roasting, sintering, blast-furnace smelting, Cottrell pptn. of roaster dust and fume, baghouse filtration of blast-furnace gases and treatment of fume for As recovery. A. BUTTS

Application of Cottrell process in lead and copper smelting. A. I. LABBE. *Trans. Am. Inst. Mining Met. Eng.* (preprint) No. 1480-D, 6 pp.—The Cottrell process is most successful on smoke that carries dust of a mech. nature and fume that contains an excess of H_2SO_4 over that to combine with the oxides present; but the baghouse is better for smoke of a basic character. Acidifying or "conditioning" basic smoke for Cottrell pptn. is practiced, but is expensive. Examples of Cottrell installations are cited. A. BUTTS

The metallurgy of copper in 1924. L. S. AUSTIN. *Mineral Ind.* 33, 168-253(1924).—A review. A. B.

Recovery of copper by leaching, Ohio Copper Co. of Utah. A. E. ANDERSON AND F. K. CAMERON. *Trans. Am. Inst. Mining Met. Eng.* (preprint) No. 1496-D, 25 pp.—A caved orebody averaging about 0.88% Cu as Cu_2S is being leached *in situ*, with creek water from an open drain from Bingham and water from the Bingham mines. The water must dissolve CuSO_4 and also carry O to the Cu_2S for continuing oxidation within the ore mass. Pptn. of the Cu from soln. is on detinned scrap Fe. In the $2\frac{1}{2}$ yrs.' operation, 17,000,000 lb. of Cu has been recovered at a cost of 6.32 c. per lb., including shipping and smelter charges. Life of the enterprise is estd. at 20 yrs., producing 10,000,000 lb. a yr. Details of operation are given. A. BUTTS

Copper. W. H. WEED. *Mineral Ind.* 33, 168-217(1924).—A review of the world's Cu industry, with statistics of output, trade, prices, etc. A. B.

Manganese. CHAS. H. BEHRE, JR. *Mineral Ind.* 33, 472-89(1924).—Production, imports, prices, uses, metallurgy, and ferro alloys are discussed, with statistics. A. B.

Nickel. THOS. W. GIBSON. *Mineral Ind.* 33, 806-14(1924).—A discussion of uses sources, production and metallurgy, with statistics. A. B.

The chemistry of the Hybinette nickel-refining process. F. E. LATHE. *J. Soc. Chem. Ind.* 44, 433-8T, 443-4T(1925).—An outline of the practice of the Brit. America Nickel Co., with particular reference to chem. methods of control. Roasting of mat.

leaching, cementation of Cu on granulated unroasted mat, anode prepn., electrolysis for Ni, cathode melting, and making of malleable Ni are discussed. A. BUTTS

Molybdenum. ALAN KISSOCK AND J. D. CUTTER. *Mineral Ind.* 33, 498-500 (1924).—Discusses market and world production. A. B.

Metallurgy of zinc. W. R. INGALLS. *Mineral Ind.* 33, 751-8 (1924).—New developments are discussed. A. B.

Zinc. J. A. ZOOK. *Mineral Ind.* 33, 723-51 (1924).—Consumption, imports and exports, prices and world production are covered, with data on rolled Zn and Zn pigments. A. B.

Tungsten. C. G. FINK. *Mineral Ind.* 33, 711-22 (1924).—Discusses production in the U. S. and foreign countries, with notes on technology. A. B.

Titanium and zirconium. J. W. MARDEN. *Mineral Ind.* 33, 703-10 (1924).—A review of technology, uses and production. A. B.

Radium, uranium and vanadium. F. L. HESS. *Mineral Ind.* 33, 638-45 (1924).—Discusses sources, production and technology, with statistics. A. B.

Aluminium and bauxite. ROBT. J. ANDERSON. *Mineral Ind.* 33, 11-50 (1924).—Discusses production, market, trade and technology of Al, light alloys, bauxite, aluminous abrasives and refractories and Al salts. A. B.

Cobalt. C. W. DRURY. *Mineral Ind.* 33, 134-7 (1924).—Metallurgy, uses and production are treated. A. B.

Bismuth. C. P. LINVILLE. *Mineral Ind.* 33, 94-5 (1924).—Sources, production, metallurgy and uses are discussed. A. B.

Gold and silver. M. W. VON BERNEWITZ. *Mineral Ind.* 33, 266-353 (1924).—World production and economies, mining conditions and developments in metallurgy and milling are discussed, with statistical tables. A. B.

Iron and steel. E. F. CONE AND S. G. KOON. *Mineral Ind.* 33, 368-421 (1924).—Ore, pig iron, steel, rails, etc., are covered, giving production statistics, prices, etc., with bibliography and notes on metallurgy. A. B.

Platinum. G. F. KUNZ. *Mineral Ind.* 33, 574-90 (1924).—A statistical review of Pt and allied metals, including production, prices and technology. A. B.

Tin. ANON. *Mineral Ind.* 33, 681-702 (1924).—Discusses world's production and consumption, market and mining conditions, with bibliography. A. B.

Quicksilver. C. P. ROSS. *Mineral Ind.* 33, 632-7 (1924).—Gives data on prices and world's production, with notes on technology. A. B.

Braden Copper Co. Calton smelter. M. S. MAZANY. *Mining & Met.* 6, 474-80 (1925).—Equipment and practice in nodulizing, blast-furnace smelting, converting, and Cottrell pptn. are described. A. BUTTS

Evolution in the preparation of ores for lead blast furnaces. D. W. JESSUP. *Trans. Am. Inst. Mining Met. Eng.* (preprint) No. 1483-P, 10 pp.—A sketch of development in bedding of ores, roasting, pre-roasting and sintering, concn. treatment and dust and fume disposal. A. BUTTS

Notes on blast-furnace practice in India, with special reference to economy in coke consumption. J. L. KEENAN. *J. Iron Steel Inst.* (advance proof), Sept., 1925, 19 pp.—A description of practice of the Tata Iron & Steel Co., with detailed operating data. A. BUTTS

A study of the reactions of the basic open-hearth furnace. T. P. COLCLOUGH. *Trans. Faraday Soc.* (advance proof), 1925.—Lab. study of individual oxidation reactions such as occur in the basic open-hearth is insufficient to show what goes on in the furnace since the simple reactions are complicated by the facts that (a) the reactions may proceed not to completion, but to an equil. value, or even be reversible, (b) secondary reactions may be set up between different constituents of the system, (c) definite chem. compds. formed by secondary reactions may interfere with the progress or equil. of the primary reactions. In steel making, equil. conditions are not desired until near the time of tapping. An excess of FeO is maintained as long as possible to keep as high a velocity of reaction as is consistent with other factors. To obtain data of value each heat must be taken as a whole with every possible detail known, the various controlling factors modified, and the resulting changes noted. In this paper this method is applied to the chief primary and secondary reactions to det. (1) their equil. const., if any, (2) the influence of various factors upon these const., and on the rate at which the reactions occur. Data drawn from several heats under ordinary working conditions are presented in tabular and graphical form. The sources of O supply during a certain heat are analyzed and it is shown that 63% of the total required is supplied by the furnace gases. Oxidation of Si is found normally almost complete at the end of the melting-down stage: since the reaction is irreversible the calcn. of an equil. const. is impossible. The relative

rates of oxidation of C and P are shown to depend primarily on the basicity of the slag, and the stages at which mass and thermochem. considerations come into action are indicated. The slag is essentially a monosilicate, $2\text{RO} \cdot \text{SiO}_2$, and whatever base is in excess of this ratio is available to form with P_2O_5 a stable compd., $4\text{RO} \cdot \text{P}_2\text{O}_5$. Given FeO in the slag and a low value of "available" RO, oxidation of P will proceed up to this limiting or satg. value, and no further. Any surplus of FeO will oxidize C. If the "available" RO is high the reactions are controlled by thermochem. and mass considerations. Oxidation of C practically ceases and P is oxidized to the full extent of the O available. A study of the Mn and FeO reaction is given; a value of 10.1×10^{-4} is suggested for the equil. const. of the reaction. The bearing of the reaction on the distribution of Mn between the slag and metal, and the problem of deoxidation, is discussed. Data are given to show the close parallelism between the distribution of Mn and the process of desulfurization; the conditions for removal of S are discussed. Data are given to support the view that in certain slags there is probability of the formation of a compd. of lime and Fe_2O_3 , Ca ferrite.

D. F. McFARLAND

Use of Martin (open-hearth) slag as a flux during melting in cupola and reverberatory furnaces. H. SPATHE. *Stahl u. Eisen* 45, 297-9 (1925).—Expts. were made at the Gutehoffnungs works to det. the diminution in Fe loss from the charge and recovery of the Fe contained in Martin slag used as a flux, with such success that except in the smelting of low-P Fe, Martin slag has been used as sole flux in cupola and reverberatory furnaces for about $1\frac{1}{2}$ yrs. The coke fuel used for the initial heating of the cupola, however, must contain no Martin slag, but only limestone, to prevent initial tapping difficulties. Expts. with 3, 4 and 5% Martin slag addns. in cupola furnaces showed that in all cases nearly all the Fe in the slag went into the molten Fe. The Mn content of the Martin slag went into the cupola furnace slag, and a favorable effect was produced on the S content of the Fe bath. Decreased wear was produced on the furnace lining by the use of Martin slag. In reverberatory furnaces with 4-6% addns. of Martin slag, 80% of the Fe was recovered in the Fe bath, for material used for cast-Fe rolls.

B. C. A.

Improved oxygen lance for open hearth. T. C. FETHERSTON. *Blast Furnace & Steel Plant* 13, 374-8 (1925).—Wooden tips fitted over the end of an O_2 lance increases the life by preventing the burning of the end of the pipe. The wooden tip is especially useful in opening steel ladles and in opening the notch hole in the bottom of the soaking pits to drain off accumulated scale.

W. H. BOYNTON

Combustion control of open hearths. J. M. CONWAY. *Iron Steel Eng.* 2, XVII-XXI (1925).—C. points out the fundamental principles that should govern the design and use of controlling devices for feeding fuel and air. The amt. and cost of different fuels for equal heat units of open-hearth fuels are tabulated, also the values used per ton (909 kg.) of steel.

W. H. BOYNTON

The treatment of metal residues and scrap. I. Treating white metal residues in the melting pot. (A) The design, building, care, and firing of melting pots. E. T. RICHARZ. *Metal Ind.* (London) 27, 161-4 (1925).—The first of a series of articles on the treatment of non-ferrous metal residues and scrap. Insufficient attention has been given to melting pot construction, maintenance, etc. Pots for refining scrap Pb, refining Pb and removal of Cu, Ag and Au, for dealing quickly with small quantities of Pb, remelting Zn, and a liquation pan for scrap, dross, rich ashes, etc., are illus.

W. H. BOYNTON

Physico-chemical phenomena from melt to ingot. A. L. FEILD. *Trans. Faraday Soc.* (advance proof), 1925.—In developing a workable physico-chem. theory concerning reactions in steel making, there were applied to the successive phenomena of oxidation in the hearth of the open-hearth furnace certain well-established principles of chem. kinetics. Differential equations were obtained whose solution followed from the theory of maxima. Solution of these equations yielded values for important equil. and soly. relationships which were sufficient not only to fix the compn. of the metal bath at any given time with respect to C, Mn, Si, FeO and CO, but also to predict quantitatively the extent to which furnace or ladle addns. of ferromanganese or ferrosilicon, or both, decrease the percentage of dissolved FeO and CO. Values were also derived for the limiting compn. of basic open-hearth steel and for the min. addns. of Mn and Si which accomplish deoxidation in steels of various initial compns. The basic open-hearth only is considered in detail, although many of the equations derived and conclusions reached are of general application. Illustrative data are obtained from a basic open-hearth heat recorded graphically by Stoughton and from these and the values for soly. of FeO in pure liquid Fe were drawn the conclusions of the paper. It was found unnecessary to base these conclusions upon any premises involving assigned values for chem. equi-

• **libria, O pressures, heat of formation or sp. heats.** The paper is developed under the following headings: The kinetics of oxidation in the metal bath. Chemical action of the furnace gases. The instantaneous equil. $Mn + FeO \rightleftharpoons Fe + MnO$ in the metal phase. (The term "instantaneous equilibrium" refers to those equilibria within the metal bath which obtain at any given instant but which, as a rule, are continuously varying with time.) The instantaneous equil. $C + FeO \rightleftharpoons Fe + CO$ in the metal bath. Relation between actual partition of Fe oxide between slag and metal and the theoretical partition at equil. Deoxidizing action of ferromanganese furnace addns. The mold reactions of steels deoxidized solely by ferromanganese. The ladle reactions of steels deoxidized by Si. Relative deoxidizing, solidifying and cleansing power of Mn and Si. D. F. McFARLAND

Qualities of firebrick from a metallurgical standpoint. V. E. GRUM-GRZHIMAILO. *Blast Furnace & Steel Plant* 13, 352(1925).—G. points out that bricks required to withstand friction and chem. action should be manufd. according to special methods. Ordinary red brick with fireclay as mortar may be used for temps. of 600–700°, quartz fireclay bricks for 700–1200°, magnesite chromite bricks at 1500° for arches and 1600° for straight walls, and tridymite-Dinas bricks for 1650°. To avoid shrinkage firebricks should be fired to their sintering point. W. H. BOYNTON

• **A new direct process for the manufacture of steel.** HENNING FLÖDIN. *J. Iron Steel Inst.* (advance proof), Sept., 1925, 5 pp.—A mixt. of hematite and coal is treated in a specially designed elec. furnace (not described), with direct production of steel carrying from 0.02 to 1.32% C and very low in P and S. The mixt. is fed continuously and reduction proceeds without interruption save for tapping steel. Air is excluded and the vol. of gases and slag is very small. Details are not given, but a 300-kw. furnace has begun operating at Hagfors, Sweden. A. BUTTS

Physical chemistry in steel making. R. A. HADFIELD. *Trans. Faraday Soc.* (advance proof), 1925.—Phys. chemistry is the fundamental science of steel making, although until recent times the association between the 2 fields was insufficiently realized. The effects of the development of the regenerative furnace, the elec. furnace, the various alloy steels; of gaseous and other fuels, of proper refractories, and of constitution of binary, ternary and quaternary alloys are considered and the relation of each to phys. chemistry is pointed out. Definite means are now known for attacking from a purely theoretical basis the fundamental reactions. These are hampered by a lack of essential phys. data at high temps., such as sp. heats, heats of reaction, equil. consts., etc. The effect of O in steel must be studied and suitable means developed to allow such studies to be carried on without contamination of the melt. The high-frequency induction furnace offers advantages for this purpose. Problems of importance to the science of steel making are as follows: study of equilibria of slag reactions, mechanism of origin of slag inclusions in steel and means for their elimination, reactions between molten metals and refractory materials of the furnace, and conditions of penetration of combined and "adsorbed" oxides, study of phys. properties of slag at high temps., viscosity, fluidity, surface tension, study of mode of cooling ingots, and its relation to segregation and properties of segregates. D. F. McFARLAND

• **Control and scientific research in foundry practice.** J. COURNOT. *Technique moderne* 17, 398–405(1925).—Description of the control tests required in foundry work and of the organization and function of a foundry lab. A. PAPINEAU-COUTURE

The use of directed reflection in metallography. J. CZOCHRALESKI. *Z. anorg. allgem. Chem.* 144, 131–41(1925).—There is no consistently good method for detg. the orientation of the small crystals (crystallites) of a metal. C. proposes the use of the directed reflections, which are due to the fact that the strength of reflection of light by a crystal face depends upon its orientation. If a metal composed of cubic crystals is etched with acid and then exposed to a beam of light those crystals whose cube face meet the beam at the proper angle will reflect very strongly, while the others will not. The max. of reflected intensity is obtained when the incident beam is perpendicular to a cube face. With the help of a one- or two-circle goniometer and a mirror-and-slit system, C. was able to det. the orientation of crystallites to within 1–2°. R. J. H.

• **Some observations on oxygen in copper.** F. JOHNSON. *Metal Ind.* (London) 27, 205–9(1925).—The advantages and disadvantages of "rough-pitch" Cu in comparison with "deoxidized" Cu are outlined. As a result of observations of the phys. properties of Cu with various O content, J. concludes that Cu in the "rough-pitch" condition is the best available when high elec. cond. is of importance, but when technical factors, such as gassing, malleability, welding, etc., are in question, these are in favor of "deoxidized" Cu. A series of diagrams and studies with the microscope are described. Evidence is given to show that the cause of streaks and wrinkles on the sur

face of polished Cu are due to the presence of an oxide-rich crust. The generally accepted O content in the Cu-CuO eutectic, 0.39%, is held in doubt as being too low.

D. THUESEN

Channels in metals, which communicate with the surface. G. TAMMANN AND H. BREDEMEIER. *Z. anorg. allgem. Chem.* 142, 54-60 (1925).—Channels are left after solidification and contraction because of cooling of a molten metal. The vol. of all these channels which communicate with the surface may be detd. in 2 ways: (1) force in water under pressure so that the enclosed gas is dissolved in the water, then drive out and weigh the occluded water, (2) force into the channels an aq. soln. of a dye of known concn. and then ext. the dye and det. the amt. colorimetrically. The amt. of space occupied by the channels in Zn is detd. by the latter method to be approx. 2.0 vol. %. Different methods of treating the surface have little effect upon the channel vol. The vol. in brass increases with increasing Cu content. Cold working increases the channel vol. for Zn and Cu, but decreases it for Fe. The channel vol. for Bi, which expands on cooling, is not measurable. Method (1) for measuring the vol. is not good because the metal does not give up its water readily, and some of the water is decomp. upon heating.

R. J. HAVIGHURST

Structure of electrolytic nickel. G. WAZAU. *Z. Metallkunde* 16, 482-3 (1924).—The structure of electrolytic Ni usually consists of parallel lines of crystals packed in layers parallel to the surface of the cathode. After annealing at 600° in the absence of air, the metal shows signs of recrystn. characterized by widening of the lines and their sepn. into a series of elongated crystals. After annealing at 900° recrystn. is complete, the new crystals being smaller the greater the amt. of pressure to which the metal has previously been subjected. The hardness falls with annealing temp. from 500° to 700° very rapidly, then much more slowly, but annealing does not remove the brittleness due to occluded H, which appears at 900° to enter into solid soln. in the metal.

B. C. A.

Transformation of nickel in the neighborhood of the Curie point. W. DEL REGNO. *Atti accad. Lincei* [vi], 1, 179-81 (1925).—The transformation of ferromagnetic α -Ni into the paramagnetic β -variety, with its accompanying changes in other phys. properties, seems not to take place at any one definite temp., but to occupy a range of temp. extending over about 100°, namely, 300-400°. Certain properties of the metal show a variation as soon as the smallest portion of the metal has undergone the change, whereas others require an appreciable proportion of the whole mass to undergo the transformation before they exhibit any peculiarity.

B. C. A.

Magnetic quality of pure nickel. A. M. MALCOLM. *Proc. Roy. Soc. Edinburgh* 44, 206-8 (1924).—Pure Ni has no retentivity and the susceptibility and permeability are const. In a field of 9.18 gauss the susceptibility is 4.17 and the permeability 53.53 with a horizontal rod. In the same field and with the rod vertical, the values are 4.20 and 53.77, resp. In these weak fields, the magnetic qualities are independent of stresses in the metal.

B. C. A.

The ternary system lead-zinc-antimony. G. TAMMANN AND OTTO DAHL. *Z. anorg. allgem. Chem.* 144, 1-15 (1925).—From a knowledge of the binary systems Pb-Zn, Pb-Sb and Sb-Zn and the isotherm at 650° showing the limits of miscibility of Pb, Zn and Sb in the liquid state the behavior of ternary mixts. could be predicted with a fair degree of accuracy. The results obtained agreed with these deductions. Pb-Zn₃Sb₂ gives a binary eutectic at compn. Zn₃Sb₂ 2% and Pb 98% and 312°. In the area Pb-Sb-Zn₃Sb₂ there is a ternary eutectic the compn. of which is Pb 87.1%, Sb 12.5% and Zn 0.4% at temp. of 244.5°. In the area Pb-Zn-Zn₃Sb₂, very few data were obtained as in most of this area 2 liquid layers occur.

H. S. VAN KLOOSTER

Notes on the fatigue of non-ferrous metals. H. F. MOORE. *Mining and Metallurgy* 6, 465-7 (1925).—Fatigue of metals is really a progressive fracture. The limiting stress below which an infinite no. of repetitions of stress can be withstood without failure is about 50% of the tensile strength for wrought ferrous metals, but for non-ferrous metals this ratio is only 25 to 40%. The detn. of this endurance limit for non-ferrous metals requires a long time, as 100 million repetitions of stress may be necessary. No reliable short-time test for endurance, and no means for detecting a fatigue crack in its early stages are known. Inelastic action or slip is entirely distinct from fatigue, and the endurance limit may be either above or below the elastic limit. A harder constituent in an alloy opposes the spread of fatigue cracks. Cold working seems to have both a beneficial and a destructive action; in non-ferrous metals the net effect on fatigue strength is nil. Temps. up to 800° F. may have a beneficial effect.

G. F. C.

Deformation and recrystallization. (Theoretical considerations on the cold working of metals.) F. KÖRBER. *Stahl u. Eisen* 45, 217-23, 261-5 (1925).—Various theories of plastic deformation in crystal structures are critically examd. in the light of X-ray

expts. The mechanism of cold deformation is considered to consist in gliding along slip planes with elastic bending of the slipping lamellae and the rotation of the crystal elements in a definite orientation to the principal axis of deformation. The hardening resulting from cold deformation is attributed to fine creases or folds appearing in the slip planes during the elastic bending of the slipping lamellae and in consequent pegging against slip. The rotation of the crystal elements to a symmetrical position offering max. resistance to shear also plays a part. The final or ideal positions of the space lattice in cold-drawn Fe and Cu wire, also in cold-rolled Fe and Al sheet, are illustrated. Cold-worked material is in a state of tension, the elastically strained lattices being in an unstable state, and recrystn. takes place the earlier, the greater the deformation, and commences at the creases or folds in the slip planes. The grain size on recrystn. depends principally on the degree of cold working and the annealing temp. A diagram is given for a pure metal (Cu) showing that the smaller the deformation the greater is the ultimate grain size. For an impure metal (soft Fe) there is a crit. degree of cold working for production of the largest grain size. Mild steel is softened by the production of large crystals, but become embrittled and may be restored by a short annealing above the upper crit. point. Cold working is defined as all deformation below the temp. of the beginning of recrystn. Above this temp. the influence of time is important, as the deformation velocity may be less than, equal to, or greater than the recrystn. velocity.

B. C. A.

Recrystallization and grain growth in soft metals. M. COOK AND U. R. EVANS. *Trans. Am. Inst. Min. Met. Eng.*, Nov. 1924 (advance copy), 24 pp.—In order to obtain specimens of Pb, Sn and Cd with a moderately equiaxed structure and a smooth surface that could be etched directly without polishing, ingots of the metals were rolled down to strips 2.5 mm. thick and these were annealed at 180° for 30–60 min. For etching Pb the soln. consisted of 10% HNO₃ contg. 6 drops of 20% chromic acid per 100 cc.; for Cd this soln. was diluted with an equal bulk of water, and for Sn the most satisfactory results were obtained with a short etch in strong HCl followed by a longer etch in 1:5 acid contg. a small quantity of FeCl₃. For examg. the grain growth of these metals during annealing, oblique illumination provided by an elec. lamp on either side of the microscope revealed the grain structure more clearly than direct vertical illumination. A no. of specimens of Pb, Cd and Zn prepd. as described above were deformed by rolling and subsequently annealed at different temps. and the same area was examd. after each treatment. In this way the growth of old grains, their shrinkage and disappearance, and the birth of new grains could be readily followed. Very few cases of actual growth of old grains were noticed, the main changes on annealing consisting of the birth of new grains followed by their growth at the expense of the old grains; the new grains generally started to grow from the boundaries of old grains, especially where 3 grain boundaries met, and in many cases the no. of new grains born in a given area was approx. the same as the no. of old grains that disappeared. Two types of change appeared to take place on annealing deformed Pb: at low temps. rapid recrystn. due to, and dependent upon the degree of, previous deformation and, at temps. above 200°, comparatively slow growth of a few large crystals entirely independent of the previous history of the specimen. Spontaneous recrystn. of Pb at ordinary temps. took place only when the metal had been subjected to a deformation of 30% or more (Norbury, *C. A.* 17, 2550). Sn did not appear to undergo self-annealing at ordinary temps. and after rolling to a 28% elongation to recrystn. took place until at or about 100°; at 160° recrystn. was rapid even if the metal was only slightly deformed and the new grains soon became larger than the old ones. The recrystn. of Cd at low temps. is a function of the temp. and degree of deformation; at higher temps. the latter has very little effect and the production of coarse grains appears to be independent of the existence of stresses or deformity in the crystal structure.

B. C. A.

The influence of slight stresses on the dissolution of metals. ERIK LIEBREICH. *Metallurgie* 14, 683–4; *Chem. Zentr.* 1924, II, 238.—As a means of studying the properties of metals, 2 methods are suggested (1) the construction of a so-called *current-tension curve* to show the cathode potential as a function of the current strength and (2) the use of the *streak method* whereby the outlines of the metal are viewed on an enlarged scale against a bright background to det. whether streaks surrounding the metal can be distinguished from the liquid by the difference in optical refraction.

C. C. DAVIS

The orientation of crystals in metal test-pieces subjected to small strains followed by heat-treatment. C. F. ELAM. *Phil. Mag.* 50, 517–20 (1925).—A comparison was made of the orientation of crystals of Al, of Al-Zn (18%) alloy, and of Fe, which had been formed by straining followed by heat treatment with the object of learning whether the method of manuf. influences the orientation. The detn. of the crystal axes of 64

crystals produced by this process showed that the variety of orientation is great, although possibly some directions are more favored than others. The direction of straining does not influence the orientation of the crystals so greatly as was expected. S. C. LIND

The orientation of crystals produced by heating strained iron. C. F. ELAM. *J. Iron & Steel Inst.* 1925 (advance proof), 2 pp.; *Engineering* 120, 368(1925).—Crystals produced by heating strained Fe have different orientations, not related to the direction of straining. Only crystals sectioned through a cubic (1-0-0) plane show typical etching pits readily on etching. These pits are illustrated by 2 photomicrographs. G. F. C.

The effect of low-temperature heating on the release of internal stress in brass tubes. R. J. ANDERSON AND E. G. FAHLMAN. *J. Inst. Metals* 1925 (advance proof), 29 pp.; cf. *C. A.* 18, 3345.—A heat-treatment was sought which would prevent warping of cold-worked, brass tubing and relieve internal stresses without material loss of hardness and strength. Expts. were carried out with leaded brass tubing about 1 in. in diam., finished to 0.056 in. wall thickness. Some of the conclusions are: Internal stresses should be detd. by slitting and measuring the springing out rather than by noting the production of cracks by chem. reagents. Cold-drawn tubes may be produced practically free from longitudinal internal stress. Heating to about 300° will largely remove internal stresses with improvement in mech. properties. Internal stresses are not completely removed until the heating is sufficient to cause recrystn. and softening. G. F. COMSTOCK

Retained austenite. J. A. MATHEWS. *J. Iron & Steel Inst.* 1925 (advance proof), 10 pp.; *Engineering* 120, 368-70(1925).—Water-quenching gave a higher induction and lower coercive force than oil-quenching, and tempering after water-quenching increased the difference. Increased size of specimen in quenching increased the magnetic hardness in spite of the less drastic quenching. Changes in length and d. after different heat-treatments also support the following conclusions: Austenite is always present with martensite in hardened steels. More austenite is retained by quenching in oil than in water. Retained austenite is a cause of permanence or retentivity in magnet steels. Quenching stresses probably account for the retention of more γ -iron by oil-quenching, and possibly the real function of Cr, Mn, Ni, V, and Mo in steel is to promote the retention of austenite. G. F. COMSTOCK

Crystal deformation and hardening. M. PÓLÁNYI. *Z. Metallkunde* 17, 94-5 (1925).—It is shown that the assumption that a thin layer of crystal dust is formed along the slip boundaries of metals as the result of cold work, while the remaining crystal grains are distorted but not broken, will account for the phenomena of hardening by cold work and recrystn. on annealing, as well as for those exhibited by X-ray examn. of the worked metal. B. C. A.

Hardening of metals. G. SACHS. *Z. Metallkunde* 17, 85-93(1925).—From an extensive review of the results of previous investigators together with his own results S. concludes that the hardening of metals by cold work is due to distortion of the lattices, bending of the slip planes, or the development of internal stress varying in intensity from place to place; on annealing, the internal stress is relieved by the re-forming of the lattices. Hardening by alloying to form a solid soln. is due to bending of the slip planes by the entrance of the solute atoms into the space lattices of the solvent and consequent distortion of the lattices; the hardening effect increases with an increase in the difference in size between the atoms of the solute and the solvent and with the no. of the solute atoms. Hardening by heat treatment depends on the setting up of internal stress or internal deformation of the crystallites caused by vol. changes due to the decompn. of solid solns. The hardness of heterogeneous mixts. may be explained by considerations based on the size, shape, and distribution of the particles of the constituents, while that produced in eutectic mixts. by quenching from the liquid state is due to cold deformation of the crystallites or to a state of internal stress set up by the sudden cooling. The influence of decreasing grain size on the hardness of metals may be explained by the production of a very uneven state of internal stress due to deformation. R. C. A.

Hardening phenomena in metals as revealed by X-rays. E. SCHIEBOLD. *Z. Metallkunde* 16, 417-25, 462-80(1924).—A critical review is given of the work of previous investigators on the alterations in structure undergone by metals during cold work and subsequent annealing, as revealed by X-ray examn. (Laue and Debye-Scherrer methods), and the various theories of plastic deformation are critically discussed. In the Laue spectrograms the elliptical interference points become elongated into short black streaks when the metal is subjected to a small amt. of deformation; further deformation causes considerable distortion and bending of the streaks, which become elongated perpendicular to the direction of rolling, and the whole takes on a star-like appearance. The degree of distortion of the individual points depends on their relative

position, and the amt. of their displacement with severe cold rolling may be expressed by a curve of the fourth order. Both in the Laue and Debye-Scherrer monochromatic röntgenograms the symmetry of the design is greater, the greater the deformation of the metal. X-ray examn. of a deformed metal shows qualitatively the nature of the deformation which the metal has undergone, and also the direction and approx. the amt. of distortion which has taken place, but the uniformity of the deformation over any area and the splitting up of the individual crystal grains cannot be accurately ascertained by this method. It can be shown, however, that the plastic deformation of metals involves pure crystallographic movement of the particles along a slip plane, accompanied by more or less rotation or slip along a twinning plane, combined with a bending or tearing of the individual cryst. particles. S. believes that no satisfactory theory of the hardening of metals by cold work has yet been advanced which will explain all the known facts.

B. C. A.

Heat treatment in case-hardening. F. BRÜSEWITZ. *Stahl u. Eisen* 44, 1697-8 (1924).—Impact test-pieces of a steel contg. C 0.12%, Cr 1.50%, Ni 4%, were case-hardened at 850° in a mixt. of 60% of wood charcoal and 40% of BaCO₃ to a depth of 1/2 mm. After subjection to various heat treatments, the impact value, ball hardness, and microstructure were detd. Slow cooling on removal from the case-hardening mixt. caused large grain fracture and the Fe carbide was deposited in the case in the form of a cementite network. Low shock values were obtained which were not subsequently restored by refining the grain. Quenching in oil direct from the case-hardening treatment was preferable, but without subsequent refining the case showed an overheated structure. The steel should be annealed at 600° to convert the martensite in the cemented layer to granular pearlite, and to make the transition from core to case more gradual. Subsequent quenching from 760-800° gave a fine structure of hardenite in the case and a max. shock test. Expts. on a plain low-C steel confirmed the value of this treatment for obtaining max. toughness and best appearance of fracture and microstructure.

B. C. A.

The Herbert pendulum for determining hardness. R. MOUILLAC. *Rev. métal.* 22, 223-37 (1925).—Discussion of its use for detg. hardness, resistance of the metal to machining, velocity and degree of cold-hardening of the metal, and rate of absorption of energy under the effect of successive deformations. The nature of the marks is shown by 24 photomicrographs.

A. PAPINEAU-COUTURE

Results of some tests with the Herbert pendulum. I. GUILLET AND J. GALIBOURG. *Rev. métal.* 22, 238-44 (1925).—The tests described show that the pendulum requires certain skill, both for its adjustment and manipulation; and when properly used it can give valuable information which other hardness tests cannot, more particularly in connection with phenomena affecting the surface of the metal. This is exemplified by the study of the softening of cemented and hardened pieces and by the study of the decarburization of high-speed steels by heating before quenching.

A. P.-C.

Observations on the use of the Herbert pendulum. P. NICOLAU. *Rev. métal.* 22, 245-50 (1925).—A discussion of the possibilities of the instrument, and of the tests which might be undertaken to ascertain definitely the nature of the information which it gives us as to the nature of the material tested; together with suggestions with regard to desirable modifications in the details of the construction of the app.

A. P.-C.

Methods and aims in refining cast iron. P. GOERENS. *Stahl u. Eisen* 45, 137-40 (1925).—A summary of known facts.

L. HUNGELMANN

Refining cast iron by alloy additions. E. PIWOWARSKY. *Stahl u. Eisen* 45, 289-97 (1925).—Expts. were made using Swedish cast Fe with 4.01% of total C as a base, by melting in a gas-fired crucible furnace and adding various ferro alloys. The alloys were divided into 3 series according to the Si content, viz.: Series I 1% Si, II 1.75% Si, and III 2.75% Si. The irons were cast into bars of 20 mm. diam. and tests were made with the casting skin on. Al (0.2-0.08%) increased the bending strength and impact value 25% in series I and II, but only slowly in series III, while the hardness and resistance to compression decreased in all series. Ti acted like Al in favoring graphite formation and had a similar effect on series I and II, while it also caused an appreciable improvement in series III. It formed non-metallic compds. in the cast Fe and had a marked effect in refining the graphite constituent. From 0.5 to 1.0% of Ni improved the mech. properties 20-30%, because of the formation of solid solns. with the Fe. Cr caused no appreciable improvement in the mech. properties. Ni and Cr together improved the mech. properties as much as 60-80% in some cases. With 0.5% of Cr the most favorable conditions were obtained with 0.2% of Ni in series I and 0.4-0.8% in series II and III. V favored the formation of carbides and increased the hardness, bending strength, toughness, d., and resistance to wear. The improvement

started suddenly with 0.5% V and was greater in series I and II than in series III. W appreciably improved all the mech. properties, probably on account of the formation of solid solns. of W-ferrite, 0.5% being sufficient to exert a favorable influence. Mo had a similar influence to W, commencing at a content of 0.5%. V in addn. to W or Mo produced only small improvements. Mn, S, and P to the amts. found in technical irons had a favorable effect on the properties of the base material, and in their presence Ni and Cr had a greater effect than on the pure Fe. In medium-hard cast Fe made in the cupola 0.2% Ni and 0.5% Cr gave no improvement in the properties. W, however, caused an improvement in all mech. properties. P. doubts if high-quality cast irons can be further improved by special addns., though perhaps irons more sensitive to heat treatment may be produced. B. C. A.

Electrolytic iron: effect of annealing on its magnetic and mechanical properties.

Micrographic study. R. CAZAUD AND R. HUGUES. *Rev. métal.* 22, 218-22(1925); cf. Cournot, C. A. 15, (56).—Changes in mech. and magnetic properties with increase in annealing temp. are tabulated, and changes in structure shown by means of photomicrographs. They are attributed to the liberation of occluded H, which is considered to be present as a solid soln. of an Fe-II compd. in Fe. Fusion in vacuum causes agglomeration of Pb which comes from the electrolytic tanks and which is too finely divided to be noticeable under the microscope in the crude Fe. It would be completely eliminated by prolonged fusion in vacuum. A. PAPINEAU-COUTURE

The magnetic and electrical properties of cast iron. J. H. PARTRIDGE. *J. Iron & Steel Inst.* 1925 (advance proof), 30 pp.—A brief review is given. Expts. were made with 30-lb. crucible-melts of washed-metal to which elements or ferro-alloys were added. Bars 1-in. round were cast in sand and machined for testing. The results are plotted as curves, and photomicrographs illustrate the structures. Some of the conclusions are: The highest induction and permeability are obtained by annealing the Fe, so that it contains temper C and no cementite. Si reduces the coercive force and hysteresis loss. Mn, Ni, and Cr decrease the induction. Al up to 1% decreases the induction and increases the coercive force and hysteresis loss. Between 1 and 3% Al produces strong opposite effects after annealing. P has little effect. Ni above 10%, with Mn, makes cast Fe non-magnetic, although sufficient Si may be present to permit machining. Co increases the induction as cast Mn and Cr may give a high coercive force, but with low remanent magnetism. Si, Mn, and Al increase the sp. resistance. G. F. C.

Heat-resisting cast iron. ANDRÉ LEVI. *Metal Ind.* (London) 26, 609-11(1925).—A summary of theories concerning growth phenomena in cast iron and statement of L.'s theory that cast irons subjected to repeated heats and cooling at temps. up to 900° undergo vol. increase accompanied by a diminution of all their mech. characteristics. The increased vol. is due to the decompn. of the cementite. Subsequent increases in vol. are due to the combined effect of internal combustion and the formation of fissures caused by the considerable stresses produced in the metal at the Ar and Ac points. The extent of vol. increases is dependent on the size and form of the graphite lamellae contained in the metal. The chief requirements for heat-resisting cast iron, and the limits of chem. analysis, for special purposes are suggested. W. H. BOYNTON

The formation of graphite in cast iron. J. E. HURST. *Metal Ind.* (London) 26, 146, 452(1925).—An abstract and discussion. H. considers that the C is in soln. in the molten iron as carbide. The graphite does not exist in soln. or free, but is formed on cooling by the decompn. of the carbide and the solid soln. Numerous arguments against this hypothesis are shown in the discussion. W. H. BOYNTON

Graphite eutectic in cast iron. EMIL SCHUEZ. *Stahl u. Eisen* 45, 144-7(1925).—Having observed that only high-Si iron when poured into thin-walled castings, occasionally produced the eutectic ferrite-graphite, S. made a survey of the effect on structure of changing Si % and rates of cooling. Si varied from 1.9 to 3.5% and the cooling rate from that of sand casting to water quenching. Below 3.0% Si no eutectic was formed; at 3.0% very little at slow cooling rate, at 3.5% Si thin-walled sand-cast or thicker-walled mold-cast pieces gave the desired eutectic structure composed of very fine graphite with ferrite. The correct Si % and rather rapid cooling rate are essential. This is in contradistinction to the view that very slow cooling favors the pptn. of the more stable form of C. Iron so made showed the very high tensile strength of 51,600 lbs./sq. in. Another advantage of this form of C is that long heating and high temps. do not affect its form so that the casting is more permanent in shape. A. H.

The effect of sulfur on the mechanical properties of white-heart malleable cast iron. E. R. TAYLOR. *Iron and Steel Inst., Carnegie Scholarship Mem.* 14, 130-61(1925).—T. shows the adverse effects of S on the mech. properties of white-heart malleable cast iron. The test bars were made from Swedish iron base and from hematite base. Nu-

merous curves, graphs, photomicrographs and chem. analyses are shown. Tensile strength, Izod impact, Brinell hardness, bend and twist tests are made, and results tabulated.

W. H. BOYNTON

The tensile properties of single iron crystals and the influence of crystal size upon the tensile properties of iron. C. A. EDWARDS AND L. B. KEEL. *J. Iron & Steel Inst.* 1925 (advance proof), 32 pp.—Large Fe crystals in strips $\frac{1}{8}$ in. thick decarburized in H were prep'd. by practically the same method as described by the authors before the Iron & Steel Inst. in 1924 (cf. *C. A.* 18, 2314). Stress-elongation curves det'd. from specimens having single crystals at the tested portion were similar to those obtained from ordinary Cu, showing no marked yield point. Tensile strengths were very uniform around 10 tons per sq. in., with 1 exception which was 50% higher. Proportional limits were 1.7 to 2.5 tons per sq. in. and showed no relation to the strength. Three types of fractures are described in detail and illustrated. The large no. of similar low strengths obtained are explained by assuming the existence of 2 slip planes in the crystals making angles of 45° to the axis of stress, and it is shown that in α Fe many different orientations fulfill that condition. With smaller single crystals the results were less uniform. Specimens of the same decarburized Fe were prep'd. with different crystal sizes and tested in the same way, the results being shown in the form of stress-elongation curves. The proportional limit was very low with large crystals, and reached a max. of 9 tons per sq. in. with about 75 crystals per sq. mm. With finer crystals it dropped to about 7 tons per sq. in. The tensile strengths increased more steadily as the crystals were finer. The yield points were most marked with about 75 crystals per sq. mm., being less well defined with both finer and coarser crystals. There was no yield point with crystals larger than 6 per sq. mm. A duplicate series of tests with specimens made from another mid-steel sheet showed similar results, except that a distinct max. tensile strength as well as proportional limit, was shown on the curves, and both occurred at a crystal size of about 145 per sq. mm. The length of yield showed a max., and the stress difference between proportional limit and yield point showed a min., at the same crystal size. The tensile strengths were about the same for coarse and fine crystals in the 2nd series. The use of N instead of H for the annealing atm. gave no difference in properties. Irregularities in size or shape of crystals increase the tensile strengths and proportional limits. Differences of this kind might perhaps account for the discontinuities in the tensile properties noted, because some of the annealing treatments were complicated but the microstructures that are illustrated do not support this hypothesis, and the authors conclude that av. crystal size was the controlling factor. G. F. C.

The influence of gases at high temperatures upon iron, with special reference to the formation of blowholes. A. GYLYNE LOBLEY AND C. L. BETTS. *J. Iron and Steel Inst.* 1925 (advance proof), No. 10, 10 pp., *Engineering* 119, 591-2.—This work was undertaken to test the assumption of McCance (cf. *C. A.* 13, 219) that the formation of blowholes in Fe and steel is due to the expulsion of dissolved CO_2 on solidification. CO being easily sol. in steel while CO_2 is very much less sol. The authors melted samples of Armeo Fe (300 g.) in a vertical C-tube resistance furnace, maintaining the max. temp. in each expt. for 30 min. The temps. were similar to those prevailing in the open-hearth process, but in some cases observations up to 2000° were taken. In each expt. the gas impinged on the surface of the Fe before passing to the other parts of the furnace. The apparent d. of the treated metals was det'd. and from this the vol. of the blowholes calcd. The specimens were then exam'd. macrographically and micrographically and finally the Brinell hardness and tensile tests taken. The results were as follows: The blowhole vols. increase with the temp., probably because of comparatively fast cooling. If the rate of cooling were very slow, the max. temp. might be less important. The hardness increases with the temp. (up to 1750°), the Brinell nos. for the CO_2 series being higher than for the CO series. N_2 produced sound specimens, free from blowholes. H_2 gave an excessive vol. of blowholes. The addn. of Fe oxide in the presence of CO increased the vol. of blowholes, on account of the reaction: $\text{CO} + \text{FeO} = \text{CO}_2 + \text{Fe}$. In the CO_2 expts. the metal round the blowholes contained less C (decarburized by CO_2 during cooling) while with coal gas the metal was carburized (probably by hydrocarbons). Conclusion: McCance's hypothesis is confirmed by these expts. H. S. v. K.

Investigations of the red shortness of weld iron. E. H. SCHULZ AND W. FREYTAG. *Mitt. Vers-Anst. Dortmunder Union* 1922, 26-30; *Chem. Zentr.* 1924, II, 396.—In bending tests of weld-Fe varying in % compn. within the limits: C 0.5-1.0, Si 0.8, Mn 0.2-0.4, P 0.1-0.27, S 0.01-0.016, Cu 0.2-0.57, no relation could be found between the red shortness and the compn., even with the highest % Cu. A high temp., viz., 950° and over, and too low a temp. (750°) for bending promoted red shortness. Gradual bending was more favorable than an impulse. C. C. DAVIS

Blue-brittleness [of iron]. E. MAURER and R. MAILÄNDER. *Stahl u. Eisen* 45, 409-23 (1925).—Cold work and subsequent aging or rolling at a "blue" heat (300°) cause the curve showing the fall of impact strength with fall of temp. to be displaced to the right along the temp. axis, i. e., the metal becomes more brittle at any given temp. below 300°. This brittleness, commonly known as "blue-brittleness," is the same as that shown by ordinary unworked Fe at low temps., but the previous cold work has caused it to become more pronounced at slightly elevated temps.; it should, therefore, be more correctly termed "cold brittleness." It never appears at a "blue" heat, nor is rolling at this temp. or annealing of the rolled metal necessary to produce it, the temp. of testing being the deciding factor in the production of the brittleness. The extent of the fall in impact strength and its displacement depends on the previous history of the metal, but is always the same for Fe and steel having a pearlitic structure for the same set of conditions. The impact strength of unworked Fe increases rapidly to a max. at 100-150°, then falls to a min at 300°, after which it again increases; rolling causes a slight displacement of the curve, depending on the degree of rolling, towards the higher temps., a small amt. of rolling having a relatively greater effect than very severe rolling. Annealing of rolled metal for some time at temps. below 300° increases the effect of the rolling, but decreases it at temps. above 300° and it is immaterial whether the test-piece is cut in the direction of rolling or at right angles thereto. The bending strength rises rapidly to a max. at 50°, then falls to a min. at 200°, rising rapidly again at higher temps. The above results are explained on the theory that the cohesion (i. e., the tensile strength of a notched bar) and the resistance to slip both decrease with rise of temp., the latter much more rapidly than the former, and that the changes in the impact strength of the metal are due to changes in the ratio between these 2 properties. After rolling this ratio is reduced and falls still further on annealing up to 300°. This view is further confirmed by measurements between -180° and 500° of the tensile strength, elastic limit and elongation of soft Fe before and after rolling, and is in agreement with the theory developed by Ludwik (*C. A.* 14, 725), Maurer (*Stahl u. Eisen* 44, 1746 (1924)), and Jeffries and Archer (*C. A.* 17, 256), that the resistance to slip along slip planes produced by a change of form is increased by tempering or aging on account of the certain amt. of interlocking, which increases the hardness and therefore the brittleness of the metal. B. C. A.

Vanadium steels. E. MAURER. *Krupp-Monatsh.* 6, 165 (1925).—It appears most probable that a V hardenite does not exist; neither could a point be located corresponding to pearlite. The V carbide dissolves gradually with rising temp. and its degree of soly. depends upon the V content of the surrounding metal. On the basis of direct tests, largely phys., the formula V_4C , seems to be the correct one. C. G. F.

Vanadium in constructional steels. R. HOHAGE and A. GRÜTZNER. *Stahl u. Eisen* 44, 1713-7 (1924).—The effect of adding 0.14% and 0.30% of V to mild steel contg. 0.10-0.17% C was investigated. The steels were melted in clay crucibles and forged to bars of 25 mm. diam. Test-pieces were quenched in water from 850°, 950° and 1000° and afterwards tempered at 600° for 2 hrs. V increased the yield point and max. strength and reduced the elongation, reduction of area and impact values, proportionally to its content and exerted these effects to a greater degree as the quenching temp. was raised. With rising V content the crit. cooling velocity was diminished and a tendency to air-hardening produced. Further specimens were quenched from 950° and tempered at rising temps. from 300° to 700°, being afterwards cooled in water. The yield point and the max. strength of the V steels increased with rise of tempering temp. passing through a max. at 600°. The elongation, reduction of area and the impact values decreased with a min. at 600°. A Cr steel contg. 0.20-0.23% C and 1.0% Cr was compared with a similar steel contg. 0.34% V, the procedure being the same as before, except that the steels were quenched in oil. Similar results to those on C steels were obtained. The Cr-V steel was also compared with 2 Ni-Cr steels contg. 0.39% C, 1.4% Ni, 1.62% Cr and 0.46% C, 3.25% Ni and 1.48% Cr, resp. For the same max. strength, the impact values obtained on the Ni-Cr steels were higher than those of the Cr-V steel, after quenching and tempering. For a greater cross-section (250 mm. diam.) Ni-Cr steel gave more favorable results still, as the heat treatment penetrated more to the center of the forging. B. C. A.

Comparative studies on the behavior of refined steels during forging under the hammer and the press. F. PACHER and F. SCHMITZ. *Stahl u. Eisen* 44, 1668-74 (1924).—Low- and high-C steels, a 3½% Ni steel and 3 high-speed steels were used for the tests. Behavior at the best temp. for each steel as well as at one higher and one lower by about 225° was observed upon forging and pressing. Tensile and impact tests were made. Specimens of higher alloy content could be forged only by light

hammering and could not be pressed without flaws. Impact tests at high temps. were a good index of the forgeability under the hammer. Tensile tests indicated less perfectly the effects of pressing, probably because of the rapid cooling of the steel in contact with the dies. Previous forging by light hammer blows made even tender alloy steels press well. This improvement was confirmed by microscopic study. Whenever the carbides were broken up into finely divided globules the steel later forged well; if it occurred as massive grain boundaries poor results were obtained. A. H.

Influence of oxygen on the physical and technical properties of mild steel. A. WIMMER. *Stahl u. Eisen* 45, 73-9 (1925).—For the tests, 15 lbs. of 0.05% C steel were heated to 50° above the m. p. and the required O was added in the form of c. p. Fe_2O_3 . Up to 0.20% O all seemed dissolved in the bath. Tensile strength and impact strength drop for every increase of O to 0.20%; yield point, hardness, reduction of area drop slightly at first and then rapidly; no change was seen in the elongation. Except for the tendency to segregate, P and S seem to be much less harmful on the properties than O. The phys. tests were checked by micro-examn. and it was noted that as the O content increases the grain size also increases. Oxides occur chiefly along grain boundaries. O % in steel should receive more attention. A. HUNGELMANN

Observation on martensite and troostite. J. H. WHITELEY. *J. Iron and Steel Inst.* May, 1925 (advance proof), No. 14, 24 pp.—An investigation was made of the different structures of quenched and tempered steels, grouped under the terms martensite and troostite. The materials used were plain C steels with C content varying between 0.03 and 2.35% and Mn contents of 0.32-0.77%. Frequent use was made of a case-hardened sample of steel plate with a C content in the case of 1.50% diminishing to 0.2% in the center. The specimens were placed in a silica tube, closed at one end and the open end was fitted with a rubber stopper in a wide-mouth bottle containing 15 cc. of Hg. A second tube passing through the stopper permitted the apparatus to be exhausted and filled with dry H_2 . The closed end of the silica tube was heated in a horizontal electric furnace to the required temp. The tube was then withdrawn, placed vertically and the sample quenched in the Hg. The etchants used were a 2% alc. soln. of picric acid, an alkaline soln. of Na picrate and a 4% soln. of HNO_3 in isoamyl alcohol. Four types of martensite were recognized: (I) the felted or acicular structure found in steels up to 0.6% C, (II) numerous clearly defined crystallites with slight indication of acicular structure, in steels containing 0.6-0.75% C, (III) lenticular plates and crystallites, embedded in a minutely pitted dark matrix, in steels with a C content between 0.75% and 1.60% C, also known as martensite-austenite and (IV) martensite in the form of narrow elongated crystals, often present in a zigzag arrangement, in steels with more than 1.60% C, which are partly austenitic on quenching. These types are found only after rapid quenching. Severe quenching of exceedingly thin pieces weighing less than 0.05 g. could not suppress the structures of types I, II and III. From the fact that polished samples after heating to 1000° and rapid quenching show surface martensite (no etch necessary) the author concludes that martensite growth starts from the outside, where the greatest quenching stress occurs. This is confirmed by the fact that quenched Armco-Fe shows only martensite near the margins. Pure electrolytic Fe does not show martensite at all on quenching. Twinning was frequently noticed especially in high-carbon steels. Occasionally martensite free from surface crystallites, so-called structureless martensite, was noticed. Such martensite is also found in quenched alloy steels. Two types of troostite were distinguished: (1) the normal kind, having an irregular growth and no crystallographic outline, termed troostite A, and (2) the variety with margins determined by the crystalline form of martensite, called troostite M. Both troostites etch evenly with acid reagents and take a faint stain when treated for 10 min. with hot Na picrate. Tempering of martensites I and II results in ferrite formation with preservation of the original structure. This is explained by an extremely rapid migration of the carbide. Tempering of martensite IV between 200° and 250° (at 180° no change) transformed it into troostite M, the austenite remaining unchanged. Heating for 10 min. at 280° changed the austenite to troostite A. From several observations W. concludes that troostite A is the result of a breakdown of austenite without intermediate martensite formation, while troostite M, formed at lower temp., is the first decomposition product of martensite. Furthermore: martensite, troostite A and eutectoid pearlite are not consecutive products from austenite but alternative. True lamellar pearlite grows directly from a solid soln. Type III martensite tempered at 210° changes into a lattice-like structure, sometimes mistaken for martensite but troostitic in character. The expansion accompanying the transformation giving rise to martensite may account for the fact that surface martensite crystallites stand out in relief. The facts recorded indicate that martensite like austenite is a solid soln. of carbide in a

transitory form of iron, intermediate between γ -Fe and α -Fe, of strong twinning tendency. A series of photomicrographs (mostly $\times 850$) accompany the paper.

H. S. VAN KLOOSTER

Properties of refined steels under technical conditions of deformation. E. SIEBEL. *Stahl u. Eisen* 44, 1675-8(1924).

A. HUNGELMANN

Recrystallization of carbon steels and alloy steels. W. SCHNEIDER AND E. HOUDRE-MONT. *Stahl u. Eisen* 44, 1681-7(1924).—Low-C steels were studied. Grain count could not be used to det. recrystn. An attempt was made to follow the latter from the course of the curve in stress-strain diagrams but these were not sensitive enough, largely because of the slow rate of crystn. at the lower temps. The various steels used were therefore drawn out cold to different sizes, tests being set aside at each reduction. These were then annealed at various temps. and the strength data obtained. The C steels showed a rise in tensile strength at 200-300° and was greater with higher C. At 500° recrystn. commenced and at 650° was complete in all cases. With 1.20% Mn steel recrystn. temp. is above 500° and is complete only at 680°. For Cr-Ni steels the temp. is 500°; the rise in tensile strength at 200-300° is much less. Low-Cr steels resemble the C steels. 15.7% Cr steel showed recrystn. to begin above 600° and the rise at 200-300° is masked; W also retards recrystn. S. and H. conclude that to overcome the effects of cold work in the steels studied an annealing temp. of 700° need not be exceeded except with high-Cr and high-speed steels. Heavy reductions by cold work are permissible as the ductility is restored at the annealing temp. stated. A. H.

The reactions of plain carbon steels with nitric acid. J. H. WHITELEY AND A. F. HALLIMOND. *Iron and Steel Inst., Carnegie Scholarship Mem.* 14, 163-86(1925).—A continuation of a previous investigation (cf. C. A. 13, 2331). Expts. on the reactions of plain C-steels after such operations as quenching, tempering and cold-working are described. There is a striking similarity between fully tempered and annealed cold-worked steels. Results confirm previous ones and show that the reactions of Fe and steel with HNO₃ under specific conditions yield valuable information on the relative amts. of energy retained by the metal after the various treatments. Reaction curves are shown of pearlitic steels and pearlite, cold-worked pearlitic steels, quenched and tempered steels, and low annealed cold-worked steels. A comparison is made of tempered and cold-worked steels. The 2 conditions are really identical though reached in different manners. The progressive changes in the reaction curves of pearlitic steels with increasing C content agree with those indicated by the mixt.-rule for mixts. of pearlite and ferrite. It looks as though the ferrite component of pearlite represents a partially strained condition. The reaction curves of quenched steels point to a high energy content. The gradual decrease in tempering is traced. Evidence is given to show that the phys. condition of a well-tempered steel is the same as that resulting from annealing the cold-worked pearlitic steel just below Ac₁.

W. H. BOYNTON

Hardening of steel. F. RAPATZ AND H. POLLACK. *Stahl u. Eisen* 44, 1698-1703(1924).—The cutting power of tool steel is shown to be detd. by its toughness as well as its hardness and the retention of the latter at high temps. The depth of penetration of hardness is dependent on the crit. cooling velocity of the steel, which is detd. by the amt. of alloying elements present. The results of quenching expts. made by quenching 1 surface of square rods are given to show the effect of C, Mn, Cr and W on the depth of penetration of hardness. The sensitiveness to hardening of tool steel, i. e., its tendency to possess a coarse-grained structure when the correct hardening temperature is exceeded, is increased by the presence of Mn, Si and Ni and also by incomplete deoxidation of the steel. W, Cr, Mo and V decrease the sensitiveness of the steel. The coarse cementite network produced by forging at too high a temp. is not removed in hardening and results in a coarse fracture. Steels contg. Mn, W and Cr were found to be the best as regards invariability of length on hardening. Recent theories of hardness are critically examd., and the theory of Maurer that the C in hardened steel is atomically dispersed in the Fe lattice, thereby increasing its vol. and setting up a state of tension, is considered the most probable.

B. C. A.

Effect of the nature of the quenching medium on the variation in volume of steel during hardening. M. OKNOFF. *Messenger ind. métaux russe* Nos. 4-8, 51-61(April-Aug. 1923); *Rev. métal.* 22 (Extraits), 175-8(1925).—The variation in vol. on hardening depends on the structure of the hardened steel on account of the differences in sp. vol. of the various constituents. From a study of the variations in vol. of 3 steels (0.52, 0.60, 0.89% C, resp.) on quenching from 800° and 1000° in water (0, 15, 100°), Hg at 0°, molten Pb at 326°, lubricating oil at 0°, glycerol at 0°, coal tar at 0° and 30% CaCl₂ soln. at 0°, O. deduced the structure of the hardened steels, and micrographic examn. verified these deductions in every case.

A. PAPINEAU-COUTURE

• **Effect of low-temperature heat-treatment on the properties of cold-drawn steel wire and on its behavior under stress at raised temps.** R. H. GREAVES. Research Dept., Woolwich, *R. D. Rept.* No. 60, 31 pp. (1924).—Expts. were made on 6 samples of cold-drawn steel gun wire contg. about 0.7% C after a reduction in area of 85% by 6 drawings without annealing. The wires were imperfectly elastic and gave permanent sets for comparatively low loads. Elastic recovery was negligible at atm. temp., commenced at 100°, and was completed by heating at 200° for 1 hr. Above 220° the elastic limit began to fall unless the period of heating was correspondingly reduced. Tensile tests were made up to 600°. There was a marked rise in elastic limit, yield point, and Brinell hardness, and some increase in ultimate strength up to about 200°. For higher temps. with treatment for 1 hr. decrease in these properties took place. An increased resistance to torsion was obtained after low-temp. heat treatment up to 350°, with a max. at 150–250° for different specimens. The angle of twist at fracture decreased up to 350°. No aging effect occurred after low-temp. heat treatment. The d. of cold-drawn wire was increased by heat treatment up to 650°, the increase being most rapid from 450° to 550°, but increase in length occurred, the extension being a max. at about 450°. The highly distorted sorbitic and lamellar pearlite micro-structure of cold-drawn wire remained unchanged up to 350°. At 450° change to granular pearlite commenced, with progressive coalescence of the carbide up to 700°. After heating above the critical range the structure depended on the rate of cooling. When the stretched wire was heated under tension some of the elastic extension became permanent, and the stress fell considerably in the case of cold-drawn wire, the fall becoming less for heat-treated wire up to the temp. of its preliminary heat-treatment. Diagrams are given illustrating the relationship between initial tension, loss of tension and temp. of heating. The loss of tension occurs in the first few min. of heating. To ensure a const. tension at atm. temp. under conditions of use, the wire must be heat-treated at a temp. not below 200°. The higher the tension to be maintained the less must the temp. exceed 200°. Reheating the wire to temps. below the previous max. causes no further reduction in the tension. B. C. A.

The brittleness of zinc-plated steel. H. SUTTON. *Trans. Faraday Soc.* 21, 91–101 (1925); *Metal Ind.* (London) 26, 483–4; *Brass World* 21, 159.—Exptl. data show that Zn-plating of streamline wires used in aircraft construction increases its brittleness, whether obtained from a cyanide or a sulfate bath. The influence of colloids, agitation, temp. and the compn. of the bath are discussed. Plated wires recovered their ductility on standing at ordinary temps.; the extent is dependent upon the nature of the Zn deposit. W. H. BOYNTON

Corrosion resistance of chromium-plated steel. A. E. OLLARD. *Metal Ind.* (London) 27, 235–7 (1925).—Steel specimens were plated with Cu, Ni, Cd and Cr and with Cr over the above metals. When exposed to industrial atm. for 768 hrs., Ni, Cu and Cd plate were attacked and Cr plate was entirely removed. Cr on Cd plate flaked off. Cr on Ni or on Cu showed little corrosion and such plates are recommended for atm. corrosion. In a steam bath test Cr on Ni was the most satisfactory. Under salt spray for 122 hrs. Cr on Ni was about equal to Ni plate and better than all others. At 420° all were good except Cd plate. In practical tests steel pins in die casting molds show no attack after 5000 castings. Cr-plated lamp reflectors and automobile trimmings kept bright much longer than those nickel-plated. In discussion MacNaughton stated that Cr plate 0.0025 cm. thick withstood a salt spray for 230 days with no corrosion, and that Cr plate had a Brinell number of 600 to 700. E. L. CHAPPELL

The magnetic properties of the nickel steels. J. WUERSCHMIDT. *Krupp. Monatsh.* 6, 182 (1925).—A review. C. G. F.

The detection of strain in mild steels. T. H. TURNER AND J. D. JEVONS. *J. Iron and Steel Inst.* 1925 (advance proof), No. 12, 21 pp.; *Engineering* 119, 588–90.—The authors have reviewed the available methods for detecting strain in mild steels. Direct observation of strained material confirmed the occurrence of surface strain lines in hot-rolled mild steels, known as Lüders or Hartmann lines. That these markings indicate wedges of grain disturbance, extending clear through the sample, was proved by cutting sections parallel to the surface and etching these with a strongly acid soln. of CuCl₂. These etch marks, however, do not show unless a low-temp. annealing precedes the etching. This is illustrated by straining a piece of mild steel in 6 places by indentation, heating one end to a red heat and cooling the other end in cold water. After milling off the surface the etch marks showed up best around the third indentation from the cold end. H. S. VAN KLOOSTER

Strain detection in mild steel by special etching. J. D. JEVONS. *J. Iron and Steel Inst.* May, 1925 (advance proof), No. 13, 14 pp.; *Engineering* 119, 585–7.—Of

the methods for strain detection, discussed in the paper by Turner and Jevons (cf. preceding abstr.), the most promising was the CuCl_2 etching process, originated by Fry (cf. *C. A.* 16, 226). The sol. for macrographic etching is made up of 120 cc. concd. HCl , 100 cc. H_2O and 90 g. CuCl_2 . The specimens to be tested need not be filed, ground and polished but may be finished off with light cuts from a milling cutter and the burnished surface removed by immersion for a few minutes in dilute HNO_3 . The annealing temp. necessary for developing the strain figures was found to lie between 200 and 400°, half an hour at 200° being considered sufficient. To produce satisfactory markings plenty of solution and frequent agitation are essential. The time of immersion may vary from 5–20 min. (20 min. is the limit given by Fry) up to 60–80 hours. For all ordinary work room temperature is most suitable for the bath. The degree of distortion had little influence on the quality of the markings. A relation between chemical comp. of the steel and the strain marks could not be found except the fact that a low-C content was apparently necessary. A number of interesting pictures of different strained specimens are presented. The following conclusions are reached: (1) An abrupt change in hardness is noticed on crossing any line dividing light and dark areas on the etched specimen, the darker or distorted part always being the harder, (2) the etched lines correspond exactly to any Lüders lines produced on the surface, (3) there is reduction in cross-sectional area wherever the bands occur and (4) the etch markings are the sides or surface evidences of permanently deformed "distortion wedges."

H. S. v. K.

Wear tests on ball-bearing chromium steel. H. REDENZ. *Stahl u. Eisen* 44, 1703–8 (1924).—Ingots of ball-bearing steel, contg. 1–1.2% C and 1.2–1.9% Cr, were rolled and drawn into rings and tested without lubrication in an Amsler machine for rolling friction, the bearing surfaces being polished. Even in the hardened material wear was the consequence of local deformation and hardening and the flaking or tearing off of particles of steel. The nature of the pressure disk was important; the results were more regular if it was made of hardened material. The resistance to wear is taken to be the frictional work required to remove 1 mg. of steel, the av. value for properly annealed and hardened ball-bearing steel being 2800–3400 kg.-m. according to the load applied. Steel annealed at 735° showed less wear than that annealed at 775°. The specific wear of annealed steel increased to a max. and then decreased. The influence of compn. within the limits of the expts. was small, but steel contg. 1% C and 1.5% Cr gave the optimum results. With const. Cr content the specific wear (loss of steel per kg.-m. of work) increased with increasing C. With const. C content the total wear and the specific wear decreased with increasing Cr. The effect of variations in compn. and method of working was masked by the hardening operation, by which the resistance to wear was primarily detd. The wearing quality depends on freedom from carbide segregation and deoxidation products, porous spots and flaws. Correct annealing gives a regularly dispersed fine-grained cementite embedded in a tough matrix, the structure on hardening showing globular cementite in a martensitic ground-mass. Good results were obtained on both rolled steel and tubes.

B. C. A.

Cold-rolling of special steel. A. POMP. *Stahl u. Eisen* 44, 1694–6 (1924).—The advantages of cold-rolled strip over black sheets are discussed. The former has a smooth non-porous surface and its use permits greater accuracy in rolling and continuous operation in hardening and heat-treatment. Hot-rolled strip has a pearlitic-sorbite structure which is unsuitable for many applications. Cold rolling in conjunction with annealing between reductions gives a fine distribution of the cementite in nodules, and the steel is soft and can be readily machined. The regular distribution of fine globular cementite gives greater cutting power and retention of a cutting edge in the hardened condition. With such a distribution a shorter time of heating is necessary for hardening. P, Ni and W have no influence on the balling up of the cementite, but Si, Mn and especially Cr retard it. A steel used in aeroplane construction contg. C 0.30, Cr 1.5 and Ni 4.5–4%, after cold-rolling and annealing, had a tensile strength of 75 kg./sq. mm. and an elongation of 15% in the strip form. Low-hysteresis steel contg. up to 4% Si is improved by rolling into strip form. Above 4% Si the steel is heated to 50–250° for rolling. A 4.6% Si steel rolled at 200° bent 180° without breaking. Cold rolling, with annealing, refines the grain and the small quantity of C present is transformed into graphite with a beneficial effect on the magnetic properties. For strips of 4.6% Si steel 0.2 mm. thick the watt loss is 0.92 per kg. for $B = 10,000$ and $n = 50$.

B. C. A.

Crucible cement steel. H. NEUBAUSS. *Stahl u. Eisen* 44, 1664–8 (1924).—There is a persistent though small quantity of crucible steel still made which N. ascribes to low O content. By plotting total O in the gases in the cementation boxes against time, 2 maxima of the ratio of O/N were obtained; one at about the 6th day, one at about the 10th or 11th. The charcoal is responsible for the first only; with the scale or skin of the

steel as a contributory source. The second, which occurs at considerably higher temps., is caused by the oxidized inclusions in the steel, CO and CO₂ being formed. To prove that these can be the source, N. prepd. oxides and silicates and "cemented" them. Plain roll scale cemented in a pipe was found entirely metallic after the run with O practically nil; Fe silicate is also reduced; Mn silicate is not reduced; Fe silicate charged with 1.47 S was taken out with only 0.33% S; P was also reduced. McCance has shown that steel annealed *in vacuo* decarburizes; but if then cemented and retreated as before it will not decarburize. N. assumed that crucible steel should retain its C even after the first annealing *in vacuo*; his tests confirmed this. Therefore the low oxides in this steel are largely responsible for its valued quality. A. HUNGELMANN

Influence of certain elements on the welding properties of mild steel. P. HAHN *Stahl u. Eisen* **45**, 7-10(1925).—Mn, Si, Al, As and Cu are considered. The investigation is of a true weld where the metals are forced together by working when in the pasty condition. Arc and flame welding, which melt the metals together, are not discussed. Low-C (0.10%) open-hearth steel was used as a base and the metals to be studied were added in the ladle. The limits of percentages for a good weld were: As 0.10%, Cu 0.9%, (above 1.9% there was no sticking together at all, probably because sulfide of Cu does not dissolve the iron oxide formed). No Mn limit was found in the range 0.63-3.4%; Al 1.4%, Si 0.3%. H. states that a good weld is by no means a sticking together but a recrystn. of a crushed surface layer at high temps. Poor welds are partial-area welds due not to accident but to chem. compn. of the metal. A. H.

Steel-molding sands and their behavior under high temperatures. A. L. CURTIS. *J. Iron Steel Inst., Carnegie Scholarship Memoirs* **1925**, 89 pp.—An exhaustive study of the compn. of many argillaceous, washed SiO₂ and facing sands, with special reference to their total flux content and grain size. This is followed by a description of the method and app. used for testing steel-molding sands, under high pressure, also a means of detg. the "permeability to gas" of the sands. The permeability equals the cc. of air forced through the test piece, multiplied by the height of the test piece in cm., divided by the pressure on the manometer in g., multiplied by the area of face of test pieces in sq. cm., divided by time in min. The object of these tests is to det. the rate of flow of air per unit pressure through the standard test pieces of the sands when compressed at uniform pressures. Conclusion: More frequent control tests are necessary in choosing raw sands or prepg. facing mixt. Variation in quality of natural sands can be more quickly proved by refractory and washing tests than by chem. analysis. Numerous photomicrographs and tables are shown. W. H. BOYNTON

High-manganese steel castings. J. H. HALL. *Iron Age* **116**, 879-84(1925).—H. gives tabular summaries of over 1800 tests on steel castings, and emphasizes the combination of strength and ductility possessed by 1.25% Mn steel. Heat treatment by quenching in oil or water and reheating results in a sorbitic structure, while air cooling followed by reheating produces a structure of very finely divided pearlite and ferrite. A "plain anneal" causes a microstructure resembling that of ordinary cast steel. The special steel possesses the same tensile strength as 0.50% C steel while its elastic limit is about 5000 lbs. per sq. in. (351.6 kg./sq. cm.) its elongation is 28% compared to 20%, and the reduction of area is more than double that of the 0.50% C steel. Results indicate that the Mn content of cast steel should not be limited to 0.80%. W. H. B.

Hardened bending test as control in the production of refined steel, with special reference to unalloyed tool steel. G. KLEIN AND W. AICHHOLZER. *Stahl u. Eisen* **44**, 1734-9(1924).—Expts. were made on 3 C tool steels prepd. in basic elec. and open-hearth furnaces, forged to 44 mm. square bars, from which square or rectangular bending test-pieces of different cross-sections were cut. The test-pieces were hardened at a series of temps. above and below the temp. used in practice. The bending strength fell with decreasing cross-section, but both too large and too small sections gave irregular results. Sections of 30 x 18 mm. and 10 x 10 mm. were used. For the lower ranges of hardening temp., the time of holding the specimens at the hardening temp. up to 1 hr. had no effect on the fracture, but caused a slight regular fall in the bending strength. The greater the section the more detrimental was the effect of holding the specimen at the hardening temp. longer than necessary. The effect of the structure of the specimen before hardening was investigated. Specimens with the greatest possible proportion of granular pearlite gave the best bending tests and fracture. The lowest possible hardening temp. gave the best bending strength and greatest hardness. Bending tests made on steels low in Mn and S were above those on the standard steel contg. 0.33% Mn and 0.28% Si. The test was sensitive to differences of 0.10% Mn and 0.13% Si. The practice of passing furnace charges of tool steel on the hardened bending test reduced the hardening failures of tools to less than 0.3%. B. C. A.

Influence on the hardening of tool steels of elements usually considered detrimental.

E. MAURER AND W. HAUFÉ. *Stahl u. Eisen* 44, 1720-6(1924).—The influence of addns. of S, P, As, Cu and Sn on tool steel contg. 1.2% C was investigated by Maurer's test for sensitiveness to hardening. Forged rods 22 mm. square were quenched in brine from temps. of 780° to 1030° with intervals of 50°, the no. of hardenings performed before the appearance of cracks being recorded. The sp. vol. of the rods was also detd. after each test. By diminishing the C of the hypereutectic steel to the eutectic percentage the steel became more sensitive to hardening and to being kept too long at the hardening temp. Decreasing the Si and especially the Mn content made the tool steel less sensitive to hardening, overheating and period of heating. As up to 0.35%, had practically no effect on the hardening properties of the steel. Sn (up to 0.38%) and especially P (up to 0.26%), had an unfavorable effect. S appeared to act only indirectly by the formation of sulfide inclusions. A steel with 1.2% C and 0.462% of extraneous elements (S, P, As, Cu, Sn) was slightly less sensitive than one with 0.97% C and only 0.134% of the same elements. At normal hardening temps. the tendency to hardening cracks was not primarily due to changes in vol. on hardening. The increase in sp. vol. of the hypereutectic steel was only slightly greater than that of the eutectic steel. Overheating before hardening slightly raises the increase of vol. and appreciably increases the sensitiveness to cracking. The fractures of the quenched specimens were examd. and found to be unfavorably affected by P and Sn. Heating for 2 or 4 hrs. before quenching produced progressively worse fractures except for steels low in Mn and Si and those with higher S contents. B. C. A.

Mechanical properties of some high-speed tool steels in relation to their cutting powers. W. OERTEL AND F. PÖLZGUTER. *Stahl u. Eisen* 44, 1708-13(1924).—The cutting powers of a no. of high-speed tool steels of different compns. were detd. under standard machining conditions, and dynamic hardness tests were carried out on the same steels up to a temp. of 1100°. If the steels were hardened at too low a temp. (900-1000°) the hardness fell off at 450-500°, but if correctly hardened the hardness did not fall off rapidly till 650°. Though tempering at 580° increased the toughness and the initial hardness slightly, it did not prevent the hardness falling away rapidly at 650°. Retention of hardness was, therefore one, but not the only, cause of good cutting properties. Tensile tests were carried out on hardened test-pieces with conical end, held in special clamps at temps. up to 900°. Consistent results were not obtained below a temp. of 400°. Curves are given for a W and a Mo high-speed steel and show that the tensile strengths were practically the same in spite of the different compns. The elongation and reduction of area are practically nil up to 630-650°, but above 700° increase rapidly to a max. at 750°. Tensile tests at 620° on a W high-speed steel increased with rise of hardening temp. up to 1250°. Similar tests on a Mo high-speed steel showed a max. at a hardening temp. of 1100°. Tensile tests at temps. from 400° to 900° are not a guide to the relative cutting powers of high-speed steels. Wear tests carried out in an Amsler machine showed that the loss of weight was no smaller for good cutting steels than for those of lower quality, but tempering at 580° decreased the amt. of wear. B. C. A.

Twin formations in certain metals and alloys. A. SCHRADER AND E. WIESS. *Z. Metallkunde* 15, 284; *Chem. Zentr.* 1924, II, 233.—The formation of twin crystals in Cu, brass, bronze, Al, Ni and Ni-steel (contg. 30% Ni) was studied after solidification under normal conditions from a melt after annealing (homogenization) and after cold drawing and subsequent annealing. Twin crystals do not form in every metal but only in certain metals and alloys and under certain conditions. In no case do they form after ordinary fusion and solidification, nor after annealing or homogenizing. They do form, however, after cold working and recrystn. of Cu, brass, bronze and austenitic Ni-steel. Twin crystallites in annealed unworked castings probably represent a state of strain in the metal. C. C. DAVIS

Dilatometric analysis of alloys. General notions and applications to cast irons. PIERRE CHEVENARD AND ALBERT PORTEVIN. *Rev. métal.* 22, 357-73(1925).—Description of the Chevenard differential recording dilatometer (*C. A.* 11, 2743) and discussion of its merits, with a review of the results which have been obtained with it to date. A. PAPINEAU-COUTURE

Various nickel brasses and their heat treatments. LÉON GUILLET. *Rev. métal.* 22, 383-94(1925).—Three types of Ni brasses were studied, having the following compns. resp.: Cu 33.16, 40.70, 25.55; Ni 25.97, 23.83, 31.31; Zn 39.82, 35.05, 42.44; Pb 0.11 trace; Fe 0.91, 0.34, 0.39%. Heating and cooling curves were obtained with the Saladin-Le Chatelier app., and with the Chevenard differential recording dilatometer; hardness, elec. resistivity, and structure were all detd. after various heat treatments. The results indicate that: the crude castings are hyperquenched; when cooled very

slowly after annealing, they have a eutectoid structure; quenching in water results in hyperquenching in the first 2 alloys and gives martensitic structure with the third; drawing the temper increases the hardness appreciably, especially with hyperquenched metals; the heating and cooling curves reveal a hitherto unnoted absorption of heat at about 100° when heating. This will be further studied. Also in *Compt. rend.* **180**, 1340-2 (1925). A. PAPINEAU-COUTURE

The manufacture and uses of stellite. W. H. LOSEE. *J. Soc. Chem. Ind.* **44**, 451-2T (1925).—As a result of numerous expts. in producing a non-tarnishable metal, it was found that an addn. of W or Mo to a binary alloy of Co and Cr greatly increased the hardness. The beneficial use of this alloy—*stellite*—as a high-grade cutting tool on the lathe has been established. In comparison with high-speed steel, stellite offers a greater advantage as it works when hot as well as when cold. Its max. efficiency is reached when the lathe is geared up to make the cutting point red-hot. In particular stellite has been used in scraping the scale off hot billets before they are put through the rolls. The paper gives a detailed description of an *elec. furnace* in which the manuf. of this alloy preferably is undertaken. Data for molds, made of artificial Acheson graphite, are also given. D. THUESEN

Silver-tin amalgams. G. TAMMANN AND OTTO DAHL. *Z. anorg. allgem. Chem.* **144**, 16-39 (1925).—Although a considerable amt. of work has been done on these important dental alloys, different workers do not agree on the most suitable compn. for tooth fillings. T. and D., therefore, studied systematically the hardness, the rate at which the hardening proceeds, the resistance to breakage (impact test) and the vol. changes during hardening. These properties were studied both for amalgams made with fresh Ag-Sn filings (size of filings between 0.04 and 0.1 mm.) and for "aged" filings (heated for 30 min. at 100°). If filings with varying amts. of Ag are ground in a mortar with excess Hg, the max. amt. of Hg is taken up when fresh filings with 73% Ag (the compn. of Ag₃Sn) are used. The filings used by T. and D. were the following: 73, 67, 60, 55, 50 and 40% Ag which are mainly used in dental practice. In each case a known weight of filings was ground with (a weighed excess of) Hg for 3 min., compressed under const. pressure and tested at 35-37°. The hardness was measured by pressing a half-cylindrical steel ball of 2 mm. diam. under a pressure of 4.35 kg. for 1 min. against the polished surface. The reciprocal value of the diam. in mm. is a measure for the hardness. Curves were obtained giving the diam. as a function of the time. The final values for 2r were: 0.32, 0.36, 0.38, 0.39, 0.45 and 0.57 mm. for the fresh and 0.26, 0.37, 0.41, 0.42, 0.45 and 0.59 mm. for the aged samples made with filings of the above compn. The impact test was carried out by placing disks of 1.45 mm. thickness on a perforated Fe-cylinder and pressing a needle point with plane end of 3 mm. diam., and increasing load, until the disk broke. The weights in kg. necessary for breakage were 12, 17, 23, 21, 19 and 14 for the fresh and 17, 20, 22, —, 27 and 20 kg. for the aged samples. The vol. changes were detd. dilatometrically. The final vol. changes in cu. mm. per cc. of amalgam were for the 6 fresh samples 23, 14, 7.6, —, 0.3 and 2.2 cu. mm. and for the corresponding aged samples —5.6, —1.2, —6.2, —, —8.2 and —6.8 cu. mm. From these data it appears that amalgams made with fresh filings having 50-60% Ag are the most suitable. In addn. to these tests the behavior of hard and soft (annealed) metals and metallic compds. towards Hg was studied. The difference can be traced: (1) to a difference in density, the heated (aged) specimen being the denser and (2) to a difference in wetting by Hg. T. and D. placed a drop of Hg on a clean surface of Ag₃Sn (hardened by polishing) and another drop of equal size on soft Ag₃Sn (softened by heating for 2 hrs. in H₂ gas). By plotting the spread of the Hg as a function of the time it is noticed that the curve for the fresh Ag₃Sn is much steeper than that for the aged (heated) sample. A third factor to be considered is the flow of Hg through metallic wires. A few expts. on the flow of Hg through hard and through soft Ag-wires of different diam. are reported. The wires were bent in the form of a siphon and the weight of Hg dropping from the long arm after different times was detd. The results indicated that the hard metal has more canals than the soft. What is true for Ag probably also holds for Ag₃Sn. H. S. VAN KLOOSTER

Ultra-light alloys and their utilization on aircraft. A. M. PORTEVIN AND R. DE FLEURY. Nat. Advisory Committee for Aeronautics, *Tech. Memorandum No. 262*, 31 pp. (1924); cf. *C. A.* **18**, 522.—"Ultra-light" alloys have a sp. gr. below 2. Mg-Al-Zn alloys, with or without other metals, and Mg-Cu are the comp. alloys of this class. The mech. properties, the present possibilities of use in air-craft construction, and the principles involved in the lightening of this construction are considered from metallurgical and structural standpoints. The fundamental and preponderant importance of the modulus of elasticity of materials as related to their densities is pointed out. W. H. B.

Study of technical ferrosilicon. M. BAMBERGER, O. EINERL AND J. NUSSBAUM. *Stahl u. Eisen* 45, 141-4 (1925).—By prepg. a no. of ferrosilicons of definite compns. (technical grades plus pure Fe being used) and establishing cooling curves, the authors find that in place of the reported single eutectic point at about 55% Si, there are 2: one at about 45.7%, the other at about 55.4% and a new constituent, FeSi_2 , is shown at 50.4%. The first eutectic melted at 1200° , the second at 1215° . The crumbling in air of certain ferrosilicons of the range studied is ascribed to the breaking up of the P in the eutectic around the silicide grains. Several micrographs of ferrosilicon etched with equal parts of HF and HNO_3 diluted with H_2O and the cooling curve diagram are given. A. HUNGELMANN

Cobalt-chromium-tungsten (molybdenum) alloys. W. OERTEL AND E. PAKULLA. *Stahl u. Eisen* 44, 1717-20 (1924).—By starting from a base alloy of the following approx. compn.: C 4.0, Cr 30, W 15, Mo 2, Co 43%, a series of alloys was made contg. increasing percentages of Fe and a corresponding decrease in the proportions of other elements present. The dynamic hardness of these alloys was detd. up to 1100° in comparison with high-speed steel, and was found to decrease slowly with rising temp., the hardness of the tool steel being of the same order up to 600° and then falling rapidly. The cutting power of the cast alloys was detd. on gray Fe and heat-treated Ni-Cr steel being much greater on the latter material. Above a crit. cutting velocity, which decreased with increasing Fe content, the cutting power fell to zero. High-speed steel was superior as regards cutting power on gray Fe to the 2 alloys with highest Fe content (19.3 and 41.3% Fe), but not so good as the others (4.6 to 15.8% Fe). The cutting power of the alloys increased with the C percentage up to 1.3%, but fell off slightly at 3% C. The hardness at high temps. also increased with the C percentage. Alloys with less than 1.3% C showed on etching mixed crystals and a component resembling ledeburite; with a C content greater than 1.3% a new acicular component, probably a Cr carbide, was present. The low cutting power of the alloys on cast Fe was probably due to the breaking away of these brittle primary Cr carbides. The base alloy was very resistant to the action of the corrosive media tried, including HCl. Scaling tests at 1000° showed a loss of 4% in weight, so that the alloy was not suitable for resistance to oxidation. The alloys of this type, including stellite, are to be regarded not as substitutes for, but as complementary to high-speed steels. B. G. A.

Zinc-cadmium alloys: their shear strengths as solders. R. B. DEELEY. *J. Inst. Metals* (advance proof), 1925, 6 pp.—A solder for motorcycle frames was sought which should melt between the temp. at which coarse crystn. of the steel tubing occurs and the temp. at which the enamel on the frames is baked, or between 450° and 180° . Zn-Cd alloys with 7-85% Zn were cast in an Fe mold and rolled into soldering strips. Bright drawn steel strips were soldered in the form of shear-test joints, with ZnCl_2 soln. as a flux, and the various alloys as solder, and the joints were pulled lengthwise in a testing machine. Typical fractures are illustrated and discussed, and the strengths are tabulated. The alloy with 12.7% Zn showed the highest shear strength of over 8 tons per sq. in., and melts at about 300° . Joints made with this alloy were stronger, both in strength and fatigue, than those made with soft solder, and soldering with it did not weaken the steel as did brazing with 60-40 brass. GEO. F. COMSTOCK

Scleron (aluminium) alloys. O. REULEAUX. *Z. Metallkunde* 16, 436-7 (1924).—Scleron is the name given to a group of heat-treated Al alloys contg. 5-15% of one or more of the following metals: Cu, Ni, Zn, Mn, Si and Li. One of the best alloys of this group has d. 2.95-3.0, tensile strength 40 kg. per sq. mm., elastic limit 20 kg. per sq. mm., elongation 10%, hardness 100-120, and Erichsen test on 1-mm. sheet 5 mm. Other alloys have been prod. with greater ductility but lower elastic limit. Heating about 200° reduces the strength of the alloys considerably and entirely removes the beneficial effects of previous heat treatment. B. C. A.

The effect of artificial aging upon age-hardened aluminium alloys. K. L. KRISNER. *Metal Ind.* (London) 26, 623-6 (1925).—Two Al alloys of the class that age-harden at ordinary temp., but differ in that one contained Cu and the other did not, were aged 5 days at room temp. and then artificially aged for 16 hrs. at temps. from 60° to 175° . Tensile strength results are tabulated. Three stages are distinguishable. The stages are easily explained in the case of the Cu-bearing alloy, while 2 explanations are advanced for the alloy contg. no Cu. In one, MgZn_2 is assumed to act like CuAl_2 and in the other the 2 improving compds. Mg_2Si and MgZn_2 pass, on aging at room temp., into a state in which they cannot yet produce the max. of their improving effect. The tensile strength, elongation and flexibility of the alloys are tabulated. In the case of the Cu-bearing alloy artificial aging, following aging at room temp., is unfavorable in effect. Up to 100° the rather high elongation is further increased and the tensile

strength, which is not high, is further decreased. From 100° to 162.5°, there is an increase of strength. In the case of the alloy contg. no Cu, aging treatment at higher temps. than room temp. increases the tensile strength. Results show that the effect of additional aging, at somewhat higher temps., upon the mech. properties of an alloy previously aged at ordinary temp. is entirely influenced by the compn. of the alloy. A Cu content apparently prevents beneficial aging, because, due to the inertness of the mols. of the compd. CuAl_2 , a hardening of the alloy takes place at such high aging temps. that other important mech. properties are appreciably adversely affected. W. H. B.

The effect of artificial aging upon age-hardened aluminium alloys. MARIE L. V. GAYLER. *Metal Ind.* (London) 27, 30-2 (1925); cf. C. A. 18, 45.—Polemical (cf. Meissner, preceding abstr.). Cu alloys can be age-hardened at room temp. and but few of them can be age-hardened at elevated temps. There appears to be no ground for a classification of age-hardening alloys into those that can be age-hardened at room temps., and those that can be age-hardened at elevated temps. The age-hardening effect of MgZn_2 , if existing, is unproved, while it is fairly well established that Mg_2Si and CuAl_2 are the causes for age-hardening. W. H. BOYNTON

Normal sand-cast alloys of aluminium containing small amounts of silicon. SAMUEL DANIELS. *Ind. Eng. Chem.* 17, 485-92 (1925).—Five Al-Si alloys made up to contain 0.25, 0.50, 1.00, 3.00 and 5.00%, resp., of Si were given tensile, hardness, sp. gr. tests in the sand-cast, annealed and quenched and aged conditions. It was found that "small addns. of Si increase the strength and hardness of Al rather slowly but decrease the percentage of elongation less rapidly than does any commonly added metal except Zn. Suitable heat treatment markedly improves the ductility of the alloys without impairing their strength or hardness. The metallography of the series is described at length and comment is made concerning the interpretation of present related equilib. diagrams." D. F. MCFARLAND

Structure of iron-silicon alloys. G. PHRAGMÉN. *Stahl u. Eisen* 45, 299-300 (1925).—X-ray spectra of alloys of Fe with 14-33% of Si are given, which show that a compd. exists within this range. Microscopical examn. indicated that the compd. contains 21-22% Si, but also contains α -Fe and FeSi. Quenching expts. showed that the compd. separates from satd. Fe at 1000°. Laue photographs showed that the large grains in 2 specimens contg. 7 and 14% Si resp., cooled from 1500° to 500° in 10 min., and a specimen with 14% Si quenched from 1180° were single α -Fe crystals, which supports Oberhoffer's hypothesis (cf. C. A. 19, 1122) that in certain Si alloys there is a continuous transition from the α - to δ -iron regions. The two 14% Si specimens corresponding to Fe_2Si showed a simple face-centered lattice. B. C. A.

Graphic representation of ternary iron-carbon alloys. A. VON VEGESACK. *Stahl u. Eisen* 45, 458-61 (1925).—The representation of ternary Fe-C alloys on an equilateral triangular diagram confines the results to a small strip remote from the C apex. To overcome this disadvantage, the use of the method of Goerens is recommended, in which an isosceles triangle is employed, the distance of the C apex being proportional to the increased C scale chosen. This method fulfils the requirement that the coördinates of all points on the diagram should add up to 100. B. C. A.

An investigation of the properties of iron-carbon alloys. E. L. REED. *Iron and Steel Inst.* (London) *Carnegie Scholarship Mem.* 14, 91-130 (1925).—A study of the effect of gases on the properties of Fe-C alloys. Alloys were prepd. by melting *in vacuo* and in air. The melting procedure, the phys. and chem. properties and heat-treatments of the vacuum- and air-melted Fe-C alloys are discussed. Some of the conclusions are: Vacuum-melted alloys are sounder and freer from inclusions than the corresponding air-melted ingots. C and O_2 alone or jointly do not cause dendritic segregation, whereas added elements, especially P and Ni, do cause it. In the lower alloys, ferrite separates more freely in the vacuum-melted ingots. The brittleness of electrolytically deposited Fe is removed without any apparent change of structure by heating to 343°, while recrystall. was observed at 675°. The soly. of the air-melted alloys in HNO_3 is probably greater than that of the vacuum-melted alloys. W. H. BOYNTON

Intercrystalline shrink holes or "micro shrink holes." L. GUILLET, J. GALIBOURG AND M. BALLAY. *Rev. métal.* 22, 253-72 (1925).—After a brief outline of the mechanism of their formation, results are described of the examn. of a no. of castings of various alloys which contained more or less intercryst., or "micro-, " shrink holes, illustrated with 49 photographs and photomicrographs. The factors involved in their formation are being studied. A. PAPINEAU-COUTURE

Welded joints in cast-iron pipe. C. H. S. TUPHOLME. *Iron Coal Trades Rev.* 110, 617 (1925).—The method of bronze-welding cast-iron pipe is described in detail. J. F. BYRNE

Growth in zinc base die castings. W. G. JOHNSON. *Metal Ind.* (N. Y.) **23**, 322-3, 362-3 (1925).—Notes on the die casting alloy: Zn 92, Al 5, Cu 3%. Test specimens were made for growth and wt. tests and suspended in steam, boiling water and paraffin. Results of tensile-strength tests and % elongation in 2" (5 cm.), the effect of exposure to dry heat and steam at 93° and the increase in wt. on exposure to steam are described. Growth is of 2 types; that due to oxidation and that due to growth in size of particle. The constitutional changes have pronounced effect on strength and ductility. The time and temp. above and below the transformation point (258°) also have a direct relation to the results obtained. Wt. increase is due to oxidation and growth is caused by both oxidation and increase in particle size. Time, temp., and oxidizing media govern the degree of growth attained. Exptl. results show that small quantities of Ni and Mg have beneficial effects on the resultant properties of alloys of this type.

W. H. BOYNTON

A comparison of muriatic and sulfuric pickles in galvanizing. HEINZ BABLIK. *Metal Ind.* (London) **26**, 437-8 (1925); cf. *C. A.* **18**, 3036.

W. H. BOYNTON

Evaluation of corrosion tests. E. BLOUGH. *Proc. Am. Soc. Testing Materials* (preprint), No. **26**, 1-5 (June, 1925).—Corrosion may have an effect upon the phys. properties of a metal which can only be detd. by phys. tests. Tests upon 5 com. non-ferrous metals showed widely different corrosion changes in phys. properties. E. L. C.

Rapid corrosion of metals by acids within capillaries. LEON McCULLOCH. *J. Am. Chem. Soc.* **47**, 1940-3 (1925).—With Fe in dil. HCl pits were formed in capillary spaces such as beneath a rubber band or between clamped pieces. Bubbles of H are retained in these spaces and act as nuclei for the easy evolution of H. E. L. C.

Corrosion effect of naphtha solutions of sulfur and sulfur compounds. A. E. WOOD, CLYDE SHEELY AND A. W. TRUSTY. *Ind. Eng. Chem.* **17**, 798-802 (1925).—The corrosive action of naphtha solns. of S, mercaptans, H₂S, alkyl sulfates, etc., upon 19 common metals and alloys is qualitatively described. Various periods and temps. of test were used. Mercaptans were most generally corrosive. Only Cu, Hg and Ag were attacked by solns. of free S.

E. L. CHAPPELL

Corrosion phenomena of aluminium. W. WIEDERHOLT. *Metallborse* **14**, 677-8, 705; *Chem. Zentr.* **1924**, **11**, 238.—To det. the influence of various anions and cations on the corrosion of Al, the latter was immersed for 15 weeks in various solns. of acids, bases, salts and in H₂O. The samples were removed each 3 weeks, examd. and weighed. The results are described.

C. C. DAVIS

Tests for corrosion of boiler material at high pressure. W. LULOFFS. *Elec. Times* **66**, 689-90 (1924); *Science Abstracts* **28B**, 114.—A description and illustration of exptl. app. constructed to det. the corrosive effect of water on Fe under high pressures. Tests were made on small Fe bars 100 mm. × 15 mm. × 5 mm. cut from boiler tube, cleaned and polished, and immersed in: (1) pure distd. water; (2) distd. water at 0.1 N soln. NaCl and (3) distd. water with 0.1N NaCl and 0.01N Na₂SO₄. The test bar was carefully weighed before and after 12 hrs. exposure to the temp. and pressure conditions. The av. of several tests carried out simultaneously at pressures of 40 and 16 atm. was, resp., loss of weight in bar (1) 0.0223, 0.0217; (2) 0.0503, 0.0718; (3) 0.0684, 0.1001 g. These indicate that there is more corrosion at the higher pressure, and therefore more care should be given to the feed-water supply to higher pressure boilers, though the increase of corrosion is not at an alarming rate.

H. G.

Corrosion and erosion of steam turbine blading. E. HONEGGER. *Brown Boveri Rev.* **11**, 263-8 (1924); *Science Abstracts* **28B**, 116-17.—Steam turbine blading may become worn as a result of either corrosion or erosion, or of a combination of both. As a rule, each assists the action of the other, the products of corrosion being removed by the erosive action, exposing fresh surfaces to the action of the former. In the high-pressure stages the risk of corrosion during operation is slight, since the blading comes into contact with superheated steam. Erosion can be eliminated here by the use of hard materials, 5% Ni steel and brass being suitable for impulse and reaction turbines, resp. In the low-pressure part, consequent upon the wetness of the steam, erosion takes place, assisted by corrosion when the blading material is liable to such action. For low and medium speeds Monel metal or the comparatively soft 72:28 brass are very suitable, and are resistant to the destructive effects. When speeds of the order 200-300 m. per sec. are desired, the influence of water in the stream becomes very marked, the inertia of the particles causing them to strike the blades and be thrown outwards to the blade tips, there causing the greatest corrosion. Soft metals may be broken down in a few hrs.; hard materials must, therefore, be considered. The 5% Ni steel largely employed in the high-pressure regions is unsatisfactory for the low-pressure stages, because of its low resistance to rust. The 25% rustless Ni steel must be rejected on account of its uncertain mech.

properties, and the turbine designer is forced to consider the modern "stainless" steels which in addn. to good mech. properties possess a high resistance to corrosion and erosion, with considerable chem. inertia. Naturally such a steel, however suitable, must be rejected if it cannot be worked to the blade section. Brown, Boveri & Co. have undertaken preliminary tests, in which the conditions were chosen so that even the best materials showed signs of being attacked within a few days, while the specimens of soft material were completely destroyed in the same period. These tests are fully described and illustrated in the original. Present-day knowledge indicates that below a critical steam speed for any metal no erosion can take place, and it is the object of further research to det. this limiting velocity.

The action of water upon copper pipes. J. C. THRESH. *Lancet* 208, 675-7, (1925).—Cu is far less acted upon by H₂O than is Fe or Pb and since Cu is less deleterious than Pb, Cu pipes are far safer than Pb pipes. Waters which are acid should not be used until the acidity has been removed by treatment. All waters take up traces of Cu if allowed to stand sufficiently long therewith, but under ordinary circumstances the amt. taken up is far too small to endanger health.

H. G.

F. B. SEIBERT

Effect of sulfide content on the properties of blast-furnace slags and cements (GRÜN) 20. Heat balance and efficiency of the electric furnace as compared with other metallurgical apparatus (COUTAGNE) 4. Restoration of ancient bronzes (FINK, ELDRIDGE) 4. Deformation of the lattice of metals by mechanical action (VAN ARKEL) 2. The law of depression of freezing points in metallic alloys (HONDA, ISHAGAKI) 2. Shaft furnace for high-temperature chemical reactions (Brit. pat. 231,203) 1. Higher condensation products of AcH (for froth-flotation of ores) (U. S. pat. 1,549,833) 10.

Concentrating ores by flotation. C. K. McARTHUR, JR. U. S. 1,552,936, Sept. 8. A collectively floated sulfide product such as Cu, Pb, Ag and Zn sulfides which is contaminated with the flotation reagent used, e. g., with oil, is treated with cyanide and with NaOH or other substance which substantially reduces the "differential-flotation-inhibitory" influence of the flotation reagent present so that by another flotation operation the sulfides present in the first flotation product may be sepd. U. S. 1,552,937 specifies treating mixed sulfide ores such as those contg. Pb, Cu, Ag, Zn and Fe sulfides with free halogen and cyanide to increase the susceptibility of the sulfides to subsequent flotation sepn.

Ore froth-flotation concentration. C. H. KELLER. U. S. 1,554,216, Sept. 22. A pulp of Pb, Zn and Ag sulfide ore, Anaconda slimes, or other ore is agitated with a frothing agent such as a creosote mixt. and with a S deriv. of carbonic acid such as K xanthate which facilitates the froth-flotation sepn.

Ore froth-flotation concentration. C. P. LEWIS. U. S. 1,554,220, Sept. 22. In flotation sepn. of alk. ore pulps such as those contg. Ag and Pb and Zn sulfides, a xanthate, e. g., K xanthate, is added to facilitate fractional sepn.

Ore flotation separation. R. ELLIS. U. S. 1,555,915, Oct. 6. ZnS ore or other ore pulp is mixed with a modifying agent such as oil, CuSO₄ and H₂SO₄ and aerated to effect froth flotation, a prepd. gas contg. over 25% free O by vol. being used.

Reducing oxide ores. Y. A. DYER. U. S. 1,556,316, Oct. 6. A layer of Fe ore or other oxide ore is placed on a thin layer of carbonaceous material and CO₂ (generated from a sep. body of carbonaceous material) is passed through this layer to reduce it to CO, which in turn reduces the oxide of the overlying layer of ore.

Reclaiming core sand. J. F. GROEBE. U. S. 1,552,694, Sept. 8. The sand is crushed to sep. the particles from each other and treated with a flame and air to burn the carbonaceous coating from the grains of sand.

Distilling volatile metals from ores. E. M. JOHNSON. U. S. 1,549,880, Aug. 18. In distg. Zn or other volatile metals, the raw material is charged into either end of a horizontal retort, open at both ends, the retort is heated to distil the volatile metal and the residue is discharged through either end of the retort.

Treating gold and silver ores. F. M. DARROW. U. S. 1,549,856, Aug. 18. Carbonaceous Au and Ag ore, during or after crushing, is treated with oleaginous and saponaceous substances and the precious metals are then extd. by cyanide. Cf. C. A. 19, 461.

Treating vanadium ore. G. KUNKLE. U. S. 1,554,917, Sept. 22. Commminuted V ore is heated to about 1000° in an oxidizing atm. to form sol. compds., and the furnace charge is then treated with H₂O to dissolve the sol. substances formed.

Treating sulfidic ores, etc. F. D. S. ROBERTSON. U. S. 1,555,078, Sept. 29.

Fe sulfide ores or other metalliferous material contg. sulfides, arsenides or similar compds. is heated in a reducing atm. to remove substantially all the S, As and like compds. partly in elemental condition, and obtain a residue contg. unoxidized metals.

Treating iron ore. J. H. GILLIS. U. S. 1,549,865, Aug. 18. After heating to form a slag, without roasting, an air blast is applied to remove S and other impurities.

Treating iron ores. E. W. WESCOTT. U. S. 1,552,786, Sept. 8. Ore or other material contg. Fe oxide is treated with Cl under reducing conditions to form FeCl_3 and the FeCl_3 in vapor form, is treated with air to reform Fe oxide and Cl.

Pure iron from ore. C. E. PARSONS and S. PEACOCK. U. S. 1,555,312, Sept. 29. A substantially pure Fe is reduced from ore such as Lake Superior Fe ore at a temp. of $815\text{--}980^\circ$, by coal gas contg. 47% H or other reducing gas. Fe is then magnetically sep'd.

Treating copper ores. F. DIETZSCH. U. S. 1,553,223, Sept. 8. Oxidized or roasted Cu ore is treated with a soln. of SO_2 in an approx. sat'd. soln. of a chloride such as NaCl. The excess SO_2 is then expelled from the soln. formed which contains a complex cuprous salt and the soln. is then treated with an oxidizing agent to ppt the Cu as a cupric compd.

Copper from concentrates. G. D. VAN ARSDALE. U. S. 1,553,413, Sept. 15. Cu-bearing material such as concentrates from sulfide ore is subjected to successive leachings with an intermediate roasting.

Leaching mixed copper sulfide ores. G. D. VAN ARSDALE. U. S. 1,553,414, Sept. 15. Dry-crushed unroasted mixed ore is leached with an acid soln. contg. about 0.4–1% of ferric Fe.

Copper from ores containing iron. G. D. VAN ARSDALE. U. S. 1,553,415, Sept. 15. In the recovery of Cu from acid soln. obtained in the treatment of mixed Cu ores contg. Fe, Fe is pptd. from the soln. by the action of heat and pressure. U. S. 1,553,416 specifies leaching Cu ore with a liquor contg. Fe salts, washing the leached residues by a counter-current method, then washing the same residues by an exhaustive or circulation method yielding Fe salts and employing the resultant liquid in the prepn. of additional quantities of leach liquor.

Nickel and copper from mats, etc. R. C. STANLEY. U. S. 1,553,197, Sept. 8. In treating mats or the like, the Cu material is partially sep'd from the Ni material by furnace treatment and the Ni material still contg. some Cu is blown directly to produce metallic Ni contg. a small proportion of Cu.

Silver from sulfides. F. W. WEBER. U. S. 1,555,615, Sept. 29. Ag-bearing sulfide material is acted on by hot HNO_3 to dissolve sulfides other than that of Ag and some of the Ag sulfide, undissolved Ag sulfide is sep'd from the hot acid soln. and the sep'd. hot acid soln. is used to react with an alkali metal chloride soln. to ppt. AgCl. This ppt. is mixed with the previously sep'd Ag sulfide and Ag is recovered from the mixt.

Tin chloride and oxide. T. RONDELLI. Brit. 232,281, Nov. 15, 1923. Sn is extd. from Sn scrap or from reduced ores by treatment with Cl dissolved in CCl_4 . The Sn chloride formed may be recovered as such or the soln. formed may be distd. over lime or soda or may be agitated with and distd. over an alk. soln. to obtain the Sn as oxide or hydroxide.

Metal stock containing magnesium. A. M. HUNT. U. S. 1,555,978, Oct. 6. A compressed coherent mixt. of metals including Hg and ferro-Si (with or without ferro-Mn) is prepd. for use in treating molten Fe, steel or Ni.

Melting and pouring magnesium. H. E. BAKKEN. U. S. 1,555,956, Oct. 6. Mg or a Mg alloy is melted with exclusion of reactive gases, and, during pouring of the metal, glycerol is introduced into the container used for melting, as a protective agent.

Aluminium. K. M. WILD and F. EHLMANN. U. S. 1,550,192, Aug. 18. In recovering Al and other light metals or alloys from sheet metal waste, chips, sweepings, etc., a bath is prepd. from metal like that to be produced, with the aid of coarse pieces of the metal, the scrap, etc., is introduced into the bath and ZnCl_2 or other fluxing chloride is added and the whole is covered with a substance such as NaCl to exclude air from the recovered metal, and is stirred below this coating layer.

Aluminium. S. PEACOCK. U. S. 1,552,728, Sept. 8. A mixt. of Al silicate, alkali metal chloride and C is heated to effect reaction between the silicate and chloride and volatilization of AlCl_3 and alkali metal (e. g., Na) which further react to form Al and NaCl.

Condensing zinc. F. THARALDSEN. U. S. 1,553,646, Sept. 15. Vapors are condensed by bringing them into contact with an unbroken surface of a bath of molten Zn which is maintained bright by a surface flow from one end to the other of the bath.

Purifying molten metals. SUMET CORPORATION. Brit. 231,279, Feb. 4, 1924.

Molten metals are purified, from S, P and similar impurities, by passing through them H substantially free from O, produced by decomposing steam by use of Fe. An app. is described.

Device for withdrawing gases from blast furnaces. R. FRANCHOT. U. S. 1,555,783, Sept. 29.

Blast-furnace operation. R. FRANCHOT and K. P. McELROY. U. S. 1,555,784, Sept. 29. In operating blast furnaces producing Fe or Fe alloy, a portion of the gases produced in the hearth is withdrawn from the hot zone and the burden ratio is adjusted in direct proportion with the quantity of gases withdrawn, so as to limit the alkali concn. in the furnace and secure fuel economy.

Open-hearth furnaces. A. HERMANSEN. U. S. 1,554,631-2, Sept. 22.

Furnace for reduction of ores, etc. B. C. GOCHENOUR. U. S. 1,553,155, Sept. 8.

Rotating drum for melting zinc scrap, etc. F. THARALDSEN. U. S. 1,553,011, Sept. 8.

Smelting furnace, employing coal dust as fuel. H. LÖSCHE. U. S. 1,555,423, Sept. 29. The furnace is adapted for producing Fe or steel.

Furnace for smelting tin ores, etc. M. STROMAN. Brit. 230,925, Dec. 20, 1923.

Steel-making apparatus. A. A. RACKOFF and J. L. SHARKEY. U. S. 1,554,368, Sept. 22. The app. is arranged for removing slag from steel and for subjecting the metal to subatm. pressure as it passes from a furnace to a ladle or other container.

High-silicon magnetic steel. F. THUAUD. U. S. 1,553,488, Sept. 15. Ni and Ti are alloyed with an alloy of Fe and Si and the resulting product is annealed in a closed vessel in the presence of finely divided Fe_3O_4 . Cf. C. A. 19, 965.

Magnetic steel. F. THUAUD. U. S. 1,555,234, Sept. 29. A magnetic steel of high permeability comprises C 0.02-0.05, Mn 0.04-0.07, Si 3.50-4.20, Ni 0.05-3.0 and Ti 0.05-1.0%.

Annealing steel. W. M. SHOPPART. U. S. 1,555,523, Sept. 29. A mass of hard steel to be tempered is enclosed in an air-tight case filled with air-slaked lime and heated to about 760° for 12 hrs., allowed to cool in the case, sepd. from the lime, reheated to cherry redness and allowed slowly to cool.

Galvanizing iron. L. H. MARSHALL. U. S. 1,553,908, Sept. 15. Malleablized cast Fe is heated to a temp. well above that used in a hot Zn galvanizing bath, quenched to render the Fe immune to embrittlement when again heated, and then coated in a bath of molten Zn.

Treating malleable cast iron to avoid embrittlement. L. H. MARSHALL. U. S. 1,553,907, Sept. 15. Malleablized cast Fe is heated in a continuous furnace to a temp. within the "safety zone" (about 600-760°) and then quenched.

Alloy steel. P. A. E. ARMSTRONG and R. P. DeVRIES. U. S. 1,555,395, Sept. 29. An alloy steel of high surface stability adapted for making cutlery comprises C 0.05-0.60, Cr 5-9, Si over 1% and Ni and Si together sufficient to make the Ni-Cr-Si content together 12-15%, the remainder being mainly Fe. Cf. C. A. 19, 32.

Steel alloy. W. J. TALBOT and TALBOT-STEAD TUBE CO., LTD. Brit. 230,958, Jan. 24, 1924. A mild steel alloy low in Si, S and P contains Cu 0.12 and Cr 0.2%.

Rendering iron alloys resistant to food acids, etc. P. A. E. ARMSTRONG. U. S. 1,554,615, Sept. 22. Alloys contg. Fe together with Cr 8-30% and C 0.15-3.0% are hardened and rendered more resistant to food acids by heating to 75-575° above their upper transformation point and rapidly cooling.

Transportable and workable shapes from iron alloys. F. GREINER. U. S. 1,549,828, Aug. 18. Pieces of alloy such as an alloy of Fe with 10% of Ni are mixed with a quick-binding refractory cement and H_2O and may be coated with substances such as varnish to protect the material against the action of H_2O . This mixt. is suitable for subsequent smelting.

Magnesium alloy. E. C. BURDICK. U. S. 1,553,298, Sept. 8. Light alloys adapted for making pistons of internal-combustion engines comprise Mg 80-99.5% with traces of Fe and Si and may also contain Al (preferably about 8.5%).

Aluminium alloy. A. A. FRESNEAU. U. S. 1,555,959, Oct. 6. An alloy which is light and strong comprises Al 93.3, Cu 3.4, Ni 1, Zn 1.8 and Mg 0.5%.

Working and heat-treating aluminium-silicon alloys. METALLBANK UND METALLURGIEMFG. GES. AKT.-GES. Brit. 231,185, March 19, 1924. Al-Si alloys contg. 5-20% Si and which may also contain small proportions of Cu, Zn, Cd, Sn, Sb and metals of the Fe group are improved, before or after mech. working, by heating to temps. above 200° and slowly cooling in air or quenching in H_2O . They may be stored or aged at temps. of 100-200°.

Refining alloys of copper and aluminium. W. FRIEDRICH. U. S. 1,554,080, Sept.

15. Alloys such as Al bronze are treated in the fluid state with an alkali compd. such as NaCl or NaF.

Magnetic alloy. W. S. SMITH and H. J. GARNETT. U. S. 1,552,769, Sept. 8. An alloy adapted for use in telegraph cables, etc. comprises Ni 49-71, Fe 17-25, Cu 15-25 and Mn 0.3-0.5%. Cf. C. A. 19, 1849.

Metal pins, etc., for joining artificial teeth or other ceramic materials. W. ROHN. U. S. 1,555,315, Sept. 29. The metals used are degasified by methods such as that of U. S. 1,555,313 (cf. following pat.).

Degasifying alloys, etc. W. ROHN. U. S. 1,555,313, Sept. 29. Alloys or their compds. with metalloids, *e. g.*, an alloy of Fe and Co or of Ni and Cr, are melted *in vacuo* under a const. pressure and temp. and maintained under these conditions for some time and then subjected to the action of different temps. and pressures. U. S. 1,555,314 specifies a similar method, with a remelting of the metallic product after solidification, further to free it from gases.

Porous alloy bearings. GENERAL MOTORS RESEARCH CORPORATION. Brit. 230,896, Dec. 13, 1923. In forming porous alloys adapted for manuf. of bearings, finely divided alloying metals such as Cu and Sn are mixed with finely divided org. substances which volatilize when heated, *e. g.*, salicylic acid, benzoic acid or $C_{10}H_8$, and the mixt. is compressed to the desired form and heated in a non-oxidizing atm. to cause the metals to alloy and the org. substances to be volatilized. Graphite or Pb may be added and the formed and cooled material is impregnated with a lubricant. Cf. C. A. 19, 33.

Softening iron plated with aluminium. F. JORDAN. U. S. 1,552,744, Sept. 8. The Al-plated Fe is heated, out of contact with air, to above the m. p. of Al but below the normal crit. temp. range of Fe and then slowly cooled.

Coating one metal with another. G. H. HOWE. U. S. 1,555,578, Sept. 29. Articles such as Al tubes which are provided with a coating of a different metal, *e. g.*, Fe or steel, to protect them against high temps. are treated, to check undesired inward diffusion of the coating metal, by causing an outward diffusion of similar metal from the interior of the article, *e. g.*, from an Fe or steel lining.

Metal-treating composition containing zirconium. F. M. BECKETT. U. S. 1,553,020, Sept. 8. A compn. contg. Zr (uncombined with C), at least half as much Si as Zr and non-ferrous material such as Mn capable of lowering the m. p. of zirconia-silica slags, is used for treating molten steel.

Cutting metals by a rotating disk and electric current. O. F. A. E. GRUMPELT. U. S. 1,556,325, Oct. 6. Mech. and elec. features.

Heat-treating stacked metal sheets. P. D'H. DRESSLER. U. S. 1,556,209, Oct. 6. Mech. features.

Case-hardening composition. S. C. WILSON. U. S. 1,555,736, Sept. 29. A compn. for case hardening Fe comprises Fe 2.60, SiO_2 39.25, Mn 31.05, and org. and undetd. substances 27.10%.

Pickling metals. J. H. GRAVELL. U. S. 1,555,798, Sept. 29. A soln. of water glass is used for neutralizing the acid substances present on the surface of Fe or steel or other metals after pickling in an acid soln.

Casting ferrosilicon. E. DAME. U. S. 1,555,557, Sept. 29. In casting ferro-Si contg. less than about 20% Si the metal is tapped from the furnace at a temp. considerably above the lowest at which it can be readily cast, subjected to controlled cooling to the latter temp., sepd. from graphite which is rejected from the metal during the cooling, and then cast.

Core for hollow steel castings. C. F. ECKERT. U. S. 1,553,758, Sept. 15. An ordinary core material is covered with a coating comprising Al nitride or calcined clay and a binder such as tar or molasses. This coating serves to facilitate sepn. of the core material from the casting.

Composition for use in heat-treating metals. J. E. BURNS. U. S. 1,555,400, Sept. 29. A mixt. of $NaNO_3$, KNO_3 and $NaNO_2$ is used for a molten heat-treating bath.

Apparatus for heat-treating and annealing metal sheets, etc. H. A. LEWIS. U. S. 1,551,825, Sept. 22.

Apparatus for heat-treating, pickling and washing of brass shells or cups or other metal articles. D. L. SUMMEY. U. S. 1,554,241, Sept. 22.

Muffle furnace adapted for heat-treating steel drills, etc. D. S. O'DONOVAN. U. S. 1,555,228, Sept. 29.

Gas-fired regenerative furnace adapted for heat-treating metal articles. C. J. WRIGHT. U. S. 1,555,780, Sept. 29.

Ingot mold. F. A. BLACK. U. S. 1,555,626, Sept. 29.

Preventing "pipe" in casting ingots. A. V. CARLSSON. U. S. 1,555,237, Sept. 29.

The walls of the feeding head or "dead head" of the ingot mold are rammed with a material such as coal breeze, evolving heat under the influence of the cast metal and transferring heat to the "dead head." This heat-evolving material may be used with other materials such as molten slag or borax which form an insulating layer.

Rust-removing composition. H. SIEGEL. U. S. 1,553,881, Sept. 15. A compn. for cleaning Fe and steel is formed from NaOH 250, Na_2CO_3 4000, glycerol 125, K manganate 16 and H_2O 120,000 parts.

Rust prevention. E. F. MORRIS. U. S. 1,555,927, Oct. 6. Fe or similar metal is first coated with an aq. emulsion prep'd. from a paint contg. basic Zn chromate together with an emulsifying agent such as glue dissolved in H_2O and turpentine or other volatile thinner, and, after this coating has dried, is further coated with a paint also contg. basic Zn chromate.

Fluxes for welding. SOC. L'AIR LIQUIDE (SOC. ANON. POUR L'ETUDE ET L'EXPLOITATION DES PROCÉDÉS G. CLAUDE). Brit. 231,816, July 25, 1924. A flux for use in autogenous welding of Al, Mg and their alloys comprises KCl 30NaCl 30, BaCl_2 30 and LiF 10% or equiv. ingredients.

Aluminium welding composition. F. POST. U. S. 1,550,280, Aug. 18. LiCl 36.65, KCl 30.40, NaCl 22.65, K_2SO_4 8.20 and cryolite 2.10 parts.

Welding aluminium electrically. R. D. MERSHON and P. A. ROSS. U. S. 1,552,443, Sept. 8. Elec. condenser discharges are used for welding.

Electrode for welding tubing. N. P. SJOBRING and M. SWANSON. U. S. 1,553,728, Sept. 15. Structural features.

Aluminium solder. A. L. PENNER. U. S. 1,556,022, Oct. 6. Pb 13, Sn 11, Zn 4, Al $\frac{1}{4}$ and Sb 1 part.

10—ORGANIC CHEMISTRY

CHAS. A. ROUILLER AND CLARENCE J. WEST

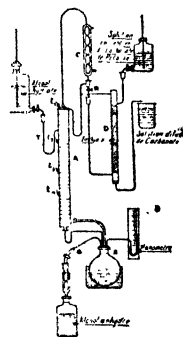
The action of aluminium chloride on heptanaphthenes. N. D. ZELINSKII AND V. A. SMIRNOV. *Brennstoff-Chem.* 6, 249-55 (1925).—Heptanaphthenes, b_{740} 101.2°, prep'd. from Baku petroleum were heated with AlCl_3 to temps. of 100° to 140° in sealed tubes. The reaction products consisted of a sat'd. gas and a mixt. of high-boiling unsat'd. liquids and a yellow non-distillable resin. The gas after condensation with acetone and CO_2 proved to be mainly isobutane. On heating the liquid residue from the tubes to 300° HCl and isobutane were evolved, leaving a C residue. Isobutane is the main product, the main reaction being one of dehydrogenation. It is believed to take place in 3 steps: heptanaphthene \rightarrow cyclobutane + $\text{H}_2 \rightarrow$ bicyclobutane + $2\text{H}_2 \rightarrow$ methylcyclopropane + $\text{H}_2 \rightarrow$ isobutane. J. D. DAVIS.

The preparation of the true acetylenic hydrocarbons. BOURGUEL. *Ann. chim.* 3, 191-235, 325-89 (1925); cf. C. A. 19, 633, 966.—A detailed study of the reaction of NaNH_2 on bromides and chlorides of the type RCHXCH_2X , RCH_2CHX_2 , RCX_2Me , RCX_2CH_2 , RCH_2CHX , yielding in each case a true acetylenic hydrocarbon. This at the termination of the reaction is in a solid combination, probably a mixt. of $\text{RC}\cdot\text{CNa}$ and $\text{RC}\cdot\text{CNH}_2\text{Na}$, from which it can be freed by ice and dil. acids. NaNH_2 at 110-60° effects the transformation of β - or γ -acetylenic hydrocarbons into true acetylenic hydrocarbons in 80% yield, thus making possible the utilization of halogens of the type RCHXCHXMe , RCX_2Et , RCX_2Pr and $\text{RCX}\cdot\text{CHMe}$ or $\text{RCX}\cdot\text{CHEt}$, and permitting the building of higher homologs with Me_2SO_4 from a given acetylenic hydrocarbon. A study of the action of PCl_5 on ketones and of Mg on propylene dibromide. *Pentine*, $\text{C}_5\text{H}_7\cdot\text{C}\cdot\text{CH}$, b. 40°, d_{17} 0.694, n_D^{17} 1.388; *hexine*, b. 71-2°, d_{17} 0.721, n_D^{19} 1.402; *heptine*, b. 100°, d_{17} 0.750, n_D^{19} 1.418; *octine*, b. 126°, d_{17} 0.762, n_D^{17} 1.426; *nonine*, b. 151°; *phenyl acetylene*, b. 142-3°; *phenylpropine*, b_{13} 67°; *cyclohexylpropine*, b_{17} 55°; β -hexine, $\text{C}_6\text{H}_7\cdot\text{C}\cdot\text{CMe}$, b. 84-5°; β -octine, b. 135.5-7°; β -nonine, b. 161°; β -cyclohexylpentine, b_{17} 93-5°; γ -heptine, $\text{C}_7\text{H}_7\cdot\text{C}\cdot\text{CEt}$, b. 106-7°; γ -octine, b. 131-1.5°; γ -heptylene, b. 97-8°. By the reaction of CO_2 on the Na deriv. of the hydrocarbon are formed, *cyclohexylbutinoic acid*, $\text{C}_6\text{H}_7\cdot\text{CH}_2\text{C}\cdot\text{CCO}_2\text{H}$, m. 69-71°; *cyclohexylpentinoic acid*, m. 37.5-9°; *cyclohexylhexinoic acid*, m. 30°; *cyclohexylheptinoic acid*, m. 40-1°.

Production of pure absolute alcohol with calcium carbide and anhydrous copper sulfate. R. E. LYONS and L. T. SMITH. *Science* 62, 224-5 (1925).—To 100 g. of 95.02 vol. % alc. in a flask attached to a reflux condenser, were added 17.5 g. granular (20 mesh) CaC_2 (81.1% pure). The alc. was kept at the boiling temp. on the water bath for 30 min., then 0.5 to 1.0 g. of anhyd. CuSO_4 was added to engage the dissolved C_2H_2 .

and S compds. Boiling under the reflux condenser was continued for 15 min. and the alc. then distd. off. The total distillate was 98.66% of the theoretical yield, d_{15} 0.7945 or 99.86 vol. % alc., of normal odor and taste, and negative to tests for C_2H_2 with Cu_2Cl_2 , S compds., aldehyde and free acid. CaC_2 is recommended over $KMnO_4$ or anhyd. $CuSO_4$ as a qual. reagent for detecting traces of H_2O in alc. L. W. RIGGS

Laboratory method and apparatus for the dehydration of alcohol. H. GUINOT. *Bull. soc. chim.* [4] 37, 1008–13(1925).—The method is essentially that of Young (*J. Chem. Soc.* 81, 707(1902)) and consists in adding C_2H_6 to 95% EtOH, and distg. Rectification is carried out in a metal column, A, 6 cm. inside diam. and contg. 30 trays spaced 26 mm. apart. The ternary EtOH- C_2H_6 - H_2O mixt. condensed in C passes through the dehydrator, D, counter-current to concd. K_2CO_3 soln. which removes practically all the H_2O . The C_2H_6 -EtOH is returned directly to the top of the column, and the diluted K_2CO_3 soln. is reclaimed by evapg. to a b. p. of 113.5° . To start up the still place 1.5 l. of EtOH in B and heat in an oil bath. Close R so that the condensate flows back and gradually fills the trays (capacity about 22 cc. each). Through T introduce 50-cc. portions of C_2H_6 , waiting a few min. after each addn., and gradually open R. Stop the addn. of C_2H_6 when t_4 (in the 6th tray from the bottom) shows a drop of about 2° (generally about 750 cc. of C_2H_6 is required), and then feed the 95% EtOH at the required rate through T. Distg. 1 l. an hr. gives abs. anhyd. EtOH, while 2 l. an hr. gives 99.6% EtOH. With alc. contg. MeOH or Me_2CO , by modifying certain details of the app. (not specified), dehydration can be carried out, and at the same time the impurities sepd. quantitatively in a state of purity.



A. PAPINEAU-COUTURE

The preparation of ethyl mercaptan in the laboratory. J. U. FERRAN. *Quim. e Industria* 2, 169–70(1925).—Good yields are obtained only when the K salts are used and the solid $EtOSO_3K$ is added to a highly concd. soln. of KSH while heat is applied very slowly to 50° .

MARY JACOBSEN

Preparation of primary acyclic amines by reduction of oximes with the aid of active aluminium. H. MAZOUREVICH. *Bull. soc. chim.* 37, 1033–43(1925).—The Al-Hg was prepd. by Lieben's method (*Monatsh.* 16, 228) and the reductions were generally effected in aq. alc. under a reflux with twice the calcd. amt. of Al. No means for stirring were available, which doubtless resulted in a lowering of the yields. In the case of the phenylhydrazones it is best to get rid of the $PhNH_2$ formed by neutralizing the reaction mixt. to litmus with a mineral acid and extg. with Et_2O or distg. with steam. Some samples of com. Al, although reacting vigorously at first, soon cease evolving H ; this was traced to the presence of small amts. of other metals, especially Cu; mech. factors (size of the Al turnings, etc.), also influence the reactivity of the Al. The reaction proceeds chiefly according to the schemes $RCH:NNHPh (+ H_2) \rightarrow RCH_2NHNHPh (+ H_2) \rightarrow RCH_2NH_2 + PhNH_2$ and $RCH:NOH \rightarrow RCH_2NHOH \rightarrow RCH_2NH_2 + H_2O$, but in some cases small amts. of sec. amines also are formed. With the phenylhydrazones, the formation of mixed and acyclic hydrazines ($RNHNHPh$ and $(NHR)_2$, resp.) has been observed. The formation of the latter is ascribed to a preliminary decompn. of the $RCH:NNHPh$ into $(RCH:N)_2$ and $(PhNH)_2$; its further reduction may give either a primary or a sec. amine. In this way from 50 g. Me_2CO through its phenylhydrazone (124 g.) is obtained with 64 g. amalgamated Al (added in 2 portions at a 2-hr. interval) 40 g. crude or 28 g. pure iso- $PrNH_2$, b. $35-45^\circ$; that some iso- $Pr)_2NH$ is present in the higher boiling fraction ($60-90^\circ$) of the product can be shown by treatment with $PhSO_2Cl$ in alk. soln. $EtC(CH_3)(Ph)Me$ (65 g.) gives 17 g. crude $EtCH(NH_2)Me$, b. $65-8^\circ$, and $(MeEtCHNH)_2$, b. $136-46^\circ$ (Franke, *Monatsh.* 19, 530, gives $170-5^\circ$), which with $PhNCS$ yields diisobutylhydrazine, $[MeEtCHN(CSNHPh)]_2$, m. $145-6^\circ$ (partial decompn.) (M. calls the group $MeEtCH$ iso-Bu; this probably explains the difference between the b. p. of his hydrazine and that of Franke.—ABST.), and with $(CO_2H)_2$ in abs. alc. an oxalate, m. $144-5^\circ$ (decompn.). From the brown oily crude phenylhydrazone from 25 g. $PrCOMe$ is obtained, together with $PhNH_2$, 4.5 g. $PrCH_2(NH_2)Me$, b. $90-5^\circ$; 70 g. crude $BuCH:NNHPh$ gives 12.5 g. crude $AmNH_2$, b. $95-103^\circ$. The phenylhydrazone from 25 g. iso-BuCHO gives 16.5 g. iso- $AmNH_2$, b. $93-101^\circ$, and 4.5 g. of a compd. with an amine-like odor, b. $173-5^\circ$, which with $(CO_2H)_2$ gives an oxalate, fatty scales, m. $157-9^\circ$ (decompn.), with $PhNCS$ a compd. m. $108-9.5^\circ$, and with $PhNCO$ a compd. m. $230-0.5^\circ$ (decompn.); the compn. of the last 2 deriva. agrees equally well with that calcd. for derivs. of (iso- $AmNH_2$) or

of AmNHNHPh, but the compn. of the oxalate (found $(\text{CO}_2\text{H})_2$, 34.56–34.92%) and the b. p. of the free base agree better with the view that the base is $(\text{iso-AmNH})_2$. Enanthal gives $\text{C}_7\text{H}_{15}\text{NH}_2$, b. 151–6°, in poor yield, and *sym-heptylphenylhydrazine*, b. 271–5°, oil with an aliphatic amine-piperidine-like odor, whose oxalate, m. 205–7° (decompn.), PhNCS compd. m. 150–1°, and PhNCO compd. (*1-heptyl-2,4-diphenylsemicarbazide*), m. 225–5.5° (decompn.). $\text{Me}_2\text{C}:\text{NOH}$ yields a small quantity of iso-PrNH_2 , b. 30–2°; $\text{EtC}(\text{NOH})\text{Me}$ gives $\text{EtCH}(\text{NH}_2)\text{Me}$, b. 65–70°; 17 g. enanthal oxime yields 2.5 g. $\text{C}_7\text{H}_{15}\text{NH}_2$, b. 151–5°. Reduction of the oximes of hydrocyclic ketones proceeds with difficulty and follows an abnormal course; camphor derivs. give only traces of bornylamine and those of carvone yield carvylamine much contaminated with various impurities.

C. A. R.

Catalytic hydrogenation of azines. III. Hydrogenation of diisobutylideneazine

K. A. TAIPALE *J. Russ. Phys.-Chem. Soc.* **56**, 81–107 (1925).—T. studied the products of catalytic hydrogenation of the aldazine of iso-PrCHO (diisobutylidene azine), in the presence of Pt black by the method described by him previously while dealing with the hydrogenation of the ketazine of acetone (*J. Russ. Phys.-Chem. Soc.* **54**, 654; cf. *C. A.* **17**, 3015). It is necessary to use aldazine freshly distd. under diminished pressure, as the substance is very alterable. Without the use of a solvent the hydrogenation is slow and incomplete. The most convenient solvent is MeOH. The hydrogenation of isobutylaldazine takes place in 2 phases. First 1 mol. H_2 is added with production of 2 isomeric substances, viz., isobutylisobutylidenehydrazine $\text{Me}_2\text{CHCH NNHCH}_2\text{CHMe}_2$, colorless, b. 175–6°, and azoisobutane (I); in the 2d phase a 2nd mol. H_2 unites with these 2 compds. and forms *N,N*-diisobutylhydrazine or hydrazoisobutane (II), $(\text{C}_4\text{H}_9\text{NH})_2$, m. 60–70° yield. II resembles $(\text{MeNH})_2$ and $(\text{EtNH})_2$, but differs in some respects from $(\text{iso-PrNH})_2$. It is a liquid of ethereal odor, b_{736} 169.5–70°, b_{16} 70.5, b_{10} 63.5°, slightly sol. in water, easily sol. in the usual org. solvents. Its vapors are alk. towards litmus, curcuma and Congo paper. It reduces cold $\text{NH}_3\text{-AgNO}_3$. On keeping in the air it easily oxidizes into I. It gives 2 kinds of salts, acid and neutral. NO deriv. of it could not be obtained because the di-NO deriv. decomps. thus: $[\text{C}_4\text{H}_9\text{N}(\text{NO})]_2 \rightarrow (\text{C}_4\text{H}_9\text{N}=\text{N})_2 + 2\text{NO}$. The mono- and di-HCl salts of II, m. about 175° (decompn.). The oxalate $\text{II} \cdot \text{C}_2\text{H}_2\text{O}_4$, m. 170° (decompn.). The di-Bz deriv., m. 79–80°. 1,2-Diisobutylsemicarbazide, $\text{NH}_2\text{CON}(\text{C}_4\text{H}_9)\text{NHC}_4\text{H}_9$, m. 132°. 1,2-Diisobutyl-4-phenylsemicarbazide, m. 68.5–69°. Dicarbanlyldiisobutylhydrazine, $[\text{C}_4\text{H}_9\text{N}(\text{CONHPh})]_2$, m. 219.5°. 1,2-Diisobutyl-4-phenylthiosemicarbazide, m. 118.5–19°. I can be prep'd. either by oxidation of II or decompn. of its NO-deriv. or by partial reduction of the aldazine. By the latter method the yield is insignificant. The best yields are obtained by oxidizing II by the following 2 ways. (1) into 50 cc. of 15% ammonia and 21.5 g. of II, 25 g. 30% H_2O_2 is poured in small portions with stirring and cooling. After several days' standing the I is extd. with ether, the Et_2O soln. dried, the ether evapd., and the I distd. The yield of product b_{752} 143–5° is 8.5 g. (60% of the theory). (2) 20 g. of yellow HgO is added in small portions to 7.5 g. of the free II in dry ether and the mixt. is heated 0.5 hr. on the water bath. On the next day the ppt. is filtered, washed with ether and the Et_2O soln. dried and distd. under 20 mm. The yield of 51.2° fraction is 6 g. (80% of the theory). I is a yellow liquid of an unpleasant odor, insol. in water, sol. in the usual org. solvents, b_{752} 145.5–5.5°, has neither reducing nor basic properties, is quite stable and remains unchanged either on keeping or on heating for several hrs. at 159–160°. On being heated with alkalis it isomerizes into the corresponding hydrazone. It can easily be reduced by H in the presence of Pt black to II. By the action of acids II is first isomerized into the corresponding hydrazone, then the latter is split into iso-PrCHO and the corresponding salt of the primary isobutylhydrazine (III). Thus $\text{III} \cdot 2\text{HCl}$ is obtained by satg. I in cold alc. with HCl and on being warmed to 60–70° loses 1 mol. HCl and forms $\text{III} \cdot \text{HCl}$, which m. 92–3°. The oxalate, $\text{III} \cdot \text{C}_2\text{H}_2\text{O}_4$, m. 168–8°. The di-Bz deriv., m. 91.5–92°. Isobutylisobutylidenehydrazine $\text{Me}_2\text{CHCH NNHCH}_2\text{CHMe}_2$ is a liquid of a sharp odor, insol. in water, sol. in the usual org. solvents, b_{740} 175–6°, b_{12} 64.5°. Among the products of complete hydrogenation of diisobutylidene azine are found iso-BuNH_2 (b. 68.9°) and $(\text{iso-Bu})_2\text{NH}$ (b. 139–40°). After distg. the products of hydrogenation the fractions contg. the amines were distd. with abs. alc. and satd. with dry HCl, after which they were filtered, the filtrates evapd., the residues consisting of HCl salts of the amines redissolved in abs. alc. and either fractionated or transformed into the corresponding benzenesulfonamides, $\text{iso-BuNH}_2 \cdot \text{HCl}$, m. 177–8°. $(\text{iso-Bu})_2\text{NH} \cdot \text{HCl}$, m. in a closed capillary 170–5°. Nitrosodiisobutylamine is a yellow oil of intense odor, solidifies into a mass of crystals at –5°. Benzenesulfonisobutylamide, m. 52.5–53°. Benzenesulfondiisobutylamide, m. 56.5–57°.

BERNARD NELSON

The condensation of dihydroxyacetone and of methylglyoxal with thiourea. B. SJOLLEMA AND L. SEEKLES. *Rec. trav. chim.* **44**, 827-37 (1925). (In English).—In extending previous work (Sjollesma and Kam, *C. A.* **11**, 2896) the action of $\text{CS}(\text{NH}_2)_2$ on dihydroxyacetone (I) and methylglyoxal (II) was studied. I was prepd. according to Kluyver and Leeuw (*C. A.* **13**, 3202). $\text{CS}(\text{NH}_2)_2 + \text{I}$ in equimol. amts. were heated in $\text{C}_5\text{H}_5\text{N}$ soln. for 7 hrs. at 120° in the sealed tube. The soln. was evapd. *in vacuo* at 40° . The residue was dissolved in abs. EtOH and poured into 15 vols. of dry Et₂O. The supernatant liquid was shaken with charcoal, filtered and distd. The residue was repeatedly crystd. from H₂O and gave a product that appears to be 2-thio-4-hydroxy-5-methylimidazoline (III) or 5-methyl-2-thiohydantoin (Johnson, *C. A.* **7**, 1163), m. 164° . II prepd. according to Pinkus (cf. S. and K., *loc. cit.*) was treated in aq. soln. with $\text{CS}(\text{NH}_2)_2$ and allowed to stand at room temp. for several days. The soln. was concd. *in vacuo* at 40° and gave III. A few drops of H_2SO_4 facilitates the condensation greatly. The usual methods of oxidation with 10% HNO_3 , H_2O_2 or warming with AgNO_3 in EtOH soln. did not remove S from III to give the imidazole deriv. The mol. was partly destroyed and partly polymerized. Attempts to replace the S by O by means of HgO failed since here a disulfide (IV) is formed along with other compds. The same disulfide was obtained by using $\text{I}_2 + \text{NaOH}$ and air + NaHCO_3 . This compd. is difficult to reduce; $\text{Na}_2\text{S}_2\text{O}_3$ in H₂O, H_2S in EtOH and in H₂O, K_2S in EtOH and in H₂O, Na-Hg in dil. AcOH failed; Zn and Fe with H_2SO_4 or AcOH, Zn + NH_4Cl soln. destroyed the mol. The reduction to II was obtained with Na_2SO_3 in alk. soln. (Polin, Looney, *C. A.* **16**, 1790). III gives the Na nitroprusside reaction while IV does not. The polymerization of II is interpreted by a mechanism similar to that used by Davidson (*C. A.* **19**, 973) in the polymerization of pyruvyl. An aq. soln. of III to which a little NaHCO_3 is added reduces an EtOH soln. of methylene blue. E. J. WITZEMANN

The higher fatty acids of peanut oil. W. D. COFFEN. *Verslag Akad. Wetenschappen Amsterdam* **34**, 462-7 (1925); cf. *C. A.* **17**, 2560.—The higher satd. fatty acids of peanut oil constitute 3-4% of the total fatty acids and consist of a C_{20} (I) and a C_{22} (II) acid, while a C_{24} acid was not found. I is identical with the arachidic acid of the literature. II, m. $53.5-4^\circ$. The m. p. of its Et ester, $80-0.5^\circ$, fits well into the stearic acid series. This and the fact that I is a straight-chain acid and that iso-acids were never found in natural oils is strongly suggestive of II being a straight-chain compd. The sepn. of the acids was effected by fractioning under 0.001 mm. the Et esters of the acid portion crystg. from 96% alc. Ehrenstein's and Steuwer's sepn. carried out in the water-pump vacuum was necessarily imperfect. MARY JACOBSEN

Chemical study of seeds of *Pharbitis nil* chois. III. Y. ASAHINA AND S. NAKANISHI. *J. Pharm. Soc. Japan* No. **520**, 515-20 (1925); cf. *C. A.* **14**, 310; **16**, 1936.—The result of further investigations on the position of OH in ipurolic acid (I), which was shown in the 1st paper of this series to be dihydroxymyristic acid is reported. I is treated with Ac_2O , oxidized with O_3 and saponified. When the resulting oxy acid is oxidized with CrO_3 , a ketonic acid, $\text{C}_{12}\text{H}_{22}\text{O}_4$, m. $55-6^\circ$, is obtained, identical with Asano's ω -butyrocacrylic acid (II), $\text{Me}(\text{CF}_3)_2\text{CO}(\text{CH}_2)_7\text{CO}_2\text{H}$ (*C. A.* **18**, 1645), confirming, therefore, the correctness of the structural formula given in the second paper of this series, in which 1 OH is shown to be at β , and the other at κ . When the methyl ester of I is oxidized with CrO_3 , a diketonic acid methyl ester is obtained, which should give a diketone on alk. decompn. and II on acid decompn. The result was, however, that a large amt. of diketonic acid and a little of the diketone, $\text{Me}(\text{CH}_2)_7\text{CO}(\text{CH}_2)_7\text{COMe}$ (cf. *C. A.* **16**, 1936), are produced. II could not be obtained by an acid decompn., but can be produced if further treated with CrO_3 . The unsatd. acid obtained by removing β OH from I gives on reduction monohydroxymyristic acid, m. 53° . Whether or not this acid is identical with a monohydroxymyristic acid (m. 51°) discovered in essential oil of the seeds of *Angelica archangelica* by Müller (*Ber.* **14**, 24, 80), was not detd. S. T.

The specific rotation of gliadin in ethanol-water solutions. D. B. DILL AND G. L. ALSBERG. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* **63**, lxxviii (1925).—In 50% EtOH, $[\alpha]_D^{20}$ for gliadin is -90° , -91.4° and -94.2° at 20° , 30° and 40° , resp. In 60% EtOH, these values are -91.0° , -93.2° and -95.8° , resp. and, in 70% EtOH, -90.0° , -91.4° and -93.4° . In 80% EtOH, $[\alpha]_D^{20}$ is -90.2° . On warming from 20° to 30° and from 30° to 40° equil. was immediately attained but on cooling from 40° to 30° in 70% EtOH and in all, on cooling from 30° to 20° , some time elapsed before the original values were attained. Freshly prepd. solns. gave values of $[\alpha]_D^{20}$ about 1° higher than those given above but, as the solns. were warmed in the prepn., these higher values are believed to be due to the lag on cooling. I. GREENWALD

Identification of glyoxylic acid as dixanthylhydrazonoglyoxylic acid by the action

of hydrazine and xanthidrol. R. FOSSE AND A. HIEULLE. *Compt. rend.* **181**, 286-8 (1925).—From 2 g. xanthidrol (I), 0.5 cc. of 50% $N_2H_4 \cdot H_2O$, 40 cc. H_2O and 6 cc. $AcOH$ is quickly obtained a white cryst. magma of *trixanthylhydrazine*, $O(C_6H_4)_2CHNH \cdot N[CH(C_6H_4)_2O]_2$ (II), sepg. from $CHCl_3 \cdot EtOH$ in crystals with 1 H_2O lost on long heating at $100-5^\circ$, m. $159-62^\circ$ (gas evolution), resolidifies and then m. $167-75^\circ$. The still unknown hydrazone of $OHCCO_2H$ (III) exists in an aq. soln. of III and N_2H_4 , since it is pptd. from such a soln. by $I \cdot AcOH$ as *dixanthylhydrazonoglyoxylic acid*, $[O(C_6H_4)_2CH]_2NN : CHCO_2H$ (IV); 1 g. I in 200 cc. $AcOH$ is slowly added with stirring to 0.2 g. III, 200 cc. H_2O and 5 drops of 50% $N_2H_4 \cdot H_2O$; H_2O is then added until there is no further pptn., the voluminous flocculent ppt. is drained off, washed, pressed between filter paper, suspended in alc., treated with normal alc. $NaOH$ to faint permanent alkalinity, centrifuged and pptd. with $AcOH$; the voluminous cryst. ppt. (IV) seps. from $CHCl_3$ -petroleum ether with 1 mol. of H_2O lost on long heating at 105° ; *Ag salt*. From 1 to 0.1 mg. III can be identified in this way at a diln. of 1:100,000. C. A. R.

The *in vitro* production of pyruvic acid from alanine. L. W. BASF. *Compt. rend. soc. biol.* **93**, 570-1 (1925).—To a dil. soln. of alanine is added Na or $KHCO_3$, then $FeSO_4$, and the mixt. well stirred with a current of air. The ferrous iron of the ppt. is slowly oxidized to the ferric state and the Fe_2O_3 is removed by filtration. $AcCO_2H$ is formed in the mixt.; it has been demonstrated by color reactions as well as by the *p*-nitrophenylhydrazone. S. MORGULIS

A new method of preparation of the α -alkyllevulic acids. H. GAULT AND T. SALOMON. *Ann. chim.* **2**, 133-209 (1924).— $MeCOCH_2CHRCO_2H$ cannot be prepd. from the corresponding alkylmalonic esters, inasmuch as the latter cannot be distd. or prepd. pure. However the Na deriv. of methylpyridazinonecarboxylic ester.

$MeC:N.NH.CO.CH(CO_2Et).CH_3$, (prepd. from $H_2NNH_2 \cdot H_2O$ and acetonilmalonic ester (I)) condenses with alkyl iodides, yielding the corresponding α alkylpyridazinonecarboxylic ester, which with warm HCl loses H_2NNH_2 , and CO_2 , forming the α -alkyllevulic acids. I, prepd. from $MeCOCH_2Br$ and Na malonate, b_{15} $145-7^\circ$; its *phenylhydrazone* is unstable, m. 109° ; its *semicarbazone*, m. $128-30^\circ$; a *hydrazone-diacetonilmalonic ester* (by-product in the action of 1 mol. H_2NNH_2 with 2 mols. I in Et_2O), m. 43° . From I, with 1 mol. H_2NNH_2 , is obtained *Et 3-methyl-6-pyridazinone-5-carboxylate*, m. $79-80^\circ$ (free acid, m. 130°); with 2 mols. H_2NNH_2 in $EtOH$, *methylpyridazinonecarboxylic hydrazide*, m. 153° . *Di-Et ethylacetonylmalonate*, prepd. crude from the Na deriv. of I and EtI ; its *unstable phenylhydrazone*, m. $99-100^\circ$; *semicarbazone*, m. $126-7^\circ$. *Di-Et isobutylacetonylmalonate phenylhydrazone*, m. $72-3^\circ$ (unstable); *semicarbazone*, m. $128-9^\circ$. *Acetonilmalonic acid*, prepd. by sapon. in the cold, of either I or pyridoquinonecarboxylic ester, or the hydrazide, m. 145° ; its *phenylhydrazine*, m. $127-8^\circ$; its *semicarbazone*, m. $176-8^\circ$. *Ethylacetonylmalonic acid*, m. $122-3^\circ$; its *phenylhydrazone* is unstable; its *semicarbazone*, m. $176-7^\circ$. The *iso-Bu* homolog could not be prepd. without the admixture of α -isobutyllevulic acid; *mono-Et isobutylacetonylmalonate phenylhydrazone*, m. $131-2^\circ$. *Et 3,5-dimethyl-6-pyridazinone-5-carboxylate*, m. 43° ; *free acid*, m. $153-4^\circ$; *Et 5-ethyl-3-methyl-6-pyridazinone-5-carboxylate*, m. $72-3^\circ$; *free acid*, m. 137° . *Et 5-isobutyl-3-methyl-6-pyridazinone-5-carboxylate*, m. $80-1^\circ$; *free acid*, m. $122-4^\circ$. These derivs., treated with concd. HCl , give the corresponding levulic acids in good yield. *Levulic acid*, b_{15} $152-4^\circ$, m. 31° ; α -methyllevulic acid, b_{15} $144-5^\circ$; α -ethyllevulic acid, b_{15} $151-2^\circ$; its *semicarbazone*, m. $171-2^\circ$; α -isobutyllevulic acid, b_{30} $171-3^\circ$. I. P. ROLF

Camphor series. VII. Catalytic formation of menthols and menthones from *l*-menthol. SHIGERU KOMATSU AND MASAO KURATA. *Mem. Coll. Sci. Kyoto Imp. Univ.* **8A**, 247-52 (1925); cf. C. A. **19**, 2901.—*l*-Menthol, free from *d*-neomenthol, was passed over reduced Cu at $250-60^\circ$; the menthone-menthol fraction, b $200-20^\circ$, was immediately transformed into the oxime, which was a mixt. of solid and liquid. The solid oxime gave *dl*-menthone. The liquid fraction was transformed into the *semicarbazones*, which, by repeated fractional crystn., showed the presence of *l*-menthone, *dl*-isomenthone and *d*-isomenthone. The catalytic reduction of *dl*-menthone apparently gives a mixt. of *dl*-menthol, *dl*-neomenthol and *d*-neomenthol, though this point requires further study. C. J. WEST

Dissymmetry and asymmetry of molecular configuration. F. G. MANN AND W. J. POPE. *Chemistry & Industry* **44**, 833-5 (1925).—By *dissymmetry* Pasteur meant a figure, not necessarily asymmetric or devoid of symmetry, but possessed of so few elements of symmetry as still to be capable of existing in 2 enantiomorphously related configurations. Work is at present in progress upon the stereochemistry of complex salts of amines with a basicity of 3 or more, such as *1,2,3-triaminopropane*, *triamino-triethylamine* and *triaminotripropylamine*. T. S. CARSWELL

Partial reactions of enzymic carbohydrate degradation. HANS V. EULER AND OLAF SWARTZ. *Arkiv. Kemi Mineral Geol.* 9, No. 21, 1-8(1925) (In German).—The quantity of CO_2 given off by ordinary yeast fermentation was increased by the presence of Na succinate. At a temp. of 30° and a p_H 5, the amt. of CO_2 in 5 hrs. with 0.1 N Na succinate was 37% greater than without it. Similar results were obtained with 0.05 and 0.02 N solns. The effect of KNO_3 upon the fermentation of a 5% glucose soln. was very slight. At 30° there was no influence but at 16° with 0.12 N KNO_3 and 5 g. of yeast (dry wt. 1.5 g.) per 100 cc. of soln. the CO_2 was increased about 12%. The influence of ultra-violet light upon the utilization of phosphate was studied. A soln. of 0.5 g. sugar, 0.1 g. phosphate, and 0.5 g. of yeast in 10 cc. of soln. was used. 0.5 cc. samples were withdrawn and the phosphate was detd. in the form of strychnine phosphomolybdate as follows: The fermentation mixt. (0.5 cc.) was treated with 5 cc. of 4% HgCl_2 and 5 cc. of 4% HCl to ppt. the albuminoid substances. After 1 hr. these were filtered off and washed with a mixt. of the pptg. solns. Hg was removed by H_2S and the excess of H_2S removed with air. The pptn. was carried out according to Embden (*C. A.* 16, 267). There was found to be a decrease in the phosphate present in the illuminated tubes and not in those in the dark at the same temps. (25° and 20°). Increasing the temp. to 45° without illumination also decreased the phosphate. There was no decrease in phosphate when sugar was absent. The presence of 0.04 N NaF did not cause any utilization of phosphate. M. A. Youtz

The reaction of acetoacetic acid with the hexoses. T. E. FRIEDEMANN. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xxi(1925).—"In the presence of H_2O_2 , the rate of acetoacetate consumption and oxidation to acids parallels the rate of oxidation of glucose. Glucosone is not ketolytic in alk. H_2O_2 solns., although it is ketolytically active in neutral or slightly alk. solns. in the absence of H_2O_2 . This may indicate that the condensation is not with an oxidation product but with a form of glucose, before oxidation. This is possible, since in high concn. glucose and acetoacetate do react, the rate paralleling the acid formation, most of which is CO_2 ." Cf. *C. A.* 19, 242. I. GREENWALD

The constitution of diacetonegalactose. OLOF SVANBERG. *Arkiv. Kemi Mineral Geol.* 9, No. 16, 1-9(1925) (In German).—The free HO group in diacetonegalactose (I) was shown to be in the 6- rather than the 3-position by the fact that it was oxidized to galacturonic acid (II) on the one hand (66.4 and 53.5% of theory) and $(\text{CO}_2\text{H})_2$ on the other (31.7 and 27.4% of theory) by alk. KMnO_4 . I was not affected by boiling 15 min. with 1% NaOH soln. II, by treatment with strong HCl, liberated both acetone residues simultaneously with a monomol. reaction const. of 0.185×10^{-3} . I was prepd. by shaking 7 g. of galactose with 250 cc. of Me_2CO and 8 cc. concd. H_2SO_4 for 76-86 hrs. at room temp., filtering off 1-2 g. of unchanged sugar, drying the soln. with K_2CO_3 and removing the excess Me_2CO and traces of H_2O by vacuum distn. The sirup was then distd. under 0.5 mm., giving 3.5-5.0 g. with $[\alpha]_{\text{D}}^{18}$ yellow -44.9° . For oxidation, 2-3 g. of I was dissolved in 50 cc. H_2O and boiled 15 min. with the addn. of 0.5 g. NaOH and 7-10 g. KMnO_4 , the soln. cooled, and Mn oxides were filtered off and washed. $\text{H}_2\text{C}_2\text{O}_4$ was detd. on an aliquot of the filtrate. The II was detd. by boiling the soln. with HCl to give furfural, which was detd. as phloroglucide by the procedures of Kruges and Tollens and Lefevre and Tollens. I is believed to be identical with the product obtained by Freudenberg and Hixon (*C. A.* 18, 818). I is obtained from either α - or β -galactose. M. A. Youtz

Monosaccharide acetone compounds. OLOF SVANBERG. *Svensk Kem. Tids.* 37, 197-206(1925).—A review of the acetone sugar compds. with respect to the bearing of these on structural chemistry. A. R. ROSE

The constitution of polysaccharides. III. On plant mucilage. I. SHIGERU KOMATSU AND HIDENOSUKE UEDA. *Mem. Coll. Sci. Kyoto Imp. Univ.* 8, 51-7(1925) (In English).—The mucilage used was obtained from the bark of *Hydrangea particulata* Sieb by extn. with cold H_2O and pptn. with EtOH. It was variously treated and then analyzed. (In the following, the first pair of figures is % of C, the next pair, % H, and the last pair, % ash.) (1) Crude mucilage, 41.1, 41.3; 5.8, 6.2; 19.7, 18.4. (2) After pptn. 4 times from H_2O with EtOH, 42.4, 42.6; 6.3, 6.4; 17.5, 18.0. (3) The H_2O soln. was dialyzed 2 weeks with toluene, then pptd. with EtOH, 41.26, 41.3; 6.4, 6.3; 14.8, 14.5. (4) Crude mucilage was treated as in (2), dissolved in 1% HCl, filtered through silk, pptd. by EtOH, washed with Et₂O, and dried *in vacuo*, 42.2, 41.8; 5.6, 5.4; 14.2, 14.2. (5) Prepn. (4) was dissolved in H_2O , allowed to stand 1 day, then pptd. with a mixt. of Me_2CO and EtOH, filtered and dried as before, 40.0, 39.3; 5.5, 5.0; 21.6, 21.5. To the filtrate Et₂O was added, pptg. more material, 47.1, 46.9; 6.2, 6.3;

7.5, 9.2. (6) The crude mucilage in H_2O soln. was filtered several times through silk cloth, centrifuged to remove needle crystals (Ca oxalate) and the clear soln. pptd. with EtOH , 42.76, 42.09; 5.68, 5.48; 9.85, 11.56. The samples all had too high ash due to Ca oxalate and too low C and H values. Fifty g. crude mucilage was boiled 4-5 hrs. with 100 cc. 1.5% H_2SO_4 . Crystals of Ca oxalate sepd. equiv. to 22% of the sample. The filtrate was neutralized with CaCO_3 , filtered, concd. *in vacuo* to a small vol., and EtOH added, pptg. the Ca salt (I) of an acidic substance. After several repts. with EtOH it amounted to 52% of the crude mucilage. The last filtrate was concd. *in vacuo* and found to contain reducing sugar equiv. to 14% of the mucilage calcd. as *d*-glucose. The osazone of *l*-arabinose, m. 160°, was isolated from the soln. 12% of the original material was unaccounted for. By boiling with 5% H_2SO_4 or stronger, *l*-arabinose and *d*-galactose are formed. The former gives furfural but the latter was isolated. Analysis, C, 39.94%; H, 6.72%; $[\alpha]_D^{20}$ 80.13°. The Ca salt (I) was a white powder and reduced Fehling soln. C, 43.61, 43.48%; H, 5.59, 5.55%; ash, 10.06, 9.61%; Ca, 6.12%; galactan 15.7; pentosan 16.09; methylpentosan, 12.96; MeO value, 3.78; CO_2 , 9.80; $[\alpha]_D^{20}$ 71.9°. This Ca salt agrees in general with the properties of mucilage except in sugar content, this difference was due probably to removal of the pentosan group during acid treatment. K and U. believe the acid to be identical with *pectic acid*. 25 g. of I was boiled with 200 cc. of 5% H_2SO_4 (becoming 3% due to the Ca present) for 3.5 hrs., the CaSO_4 filtered off, the filtrate neutralized with CaCO_3 and again filtered. The filtrate contd. 6 g. of reducing sugar calcd. as *d*-glucose. The Ca salt of an acid (II) was pptd. by 91% EtOH in a yield of 18.2 g. or 72.8% of I. 20 g. of I was boiled with 200 cc. of 5% (final value) H_2SO_4 for 5 hrs. and this gave 49% of another Ca salt (III) and 30% of reducing sugar, with a much larger treatment loss due to decompn. of pentose to furfural. Analysis of II, C, 41.31, 41.46%; H, 5.59, 5.60%; ash, 11.55%; CaO in ash, 85%; pentosan, 23.5; methylpentosan, 17.5; galactan, 17.7; $[\alpha]_D^{20}$ 67°. Analysis of III, C, 40.49, 40.02%; H, 5.78, 5.84%; ash, 14.23, 14.55%; CaO in ash, 71%; pentosan, 23.6; methylpentosan, 13.9; galactan, 20.8; CO_2 , 11.0; $[\alpha]_D^{20}$ 58°. From these results it is inferred that I contains much galacturonic acid. 3 g. of II was heated with 3% H_2SO_4 in a sealed tube at 135-45° for 3 hrs. The soln. became brown and deposited a humic substance. The filtrate was concd. *in vacuo* after being neutralized with CaCO_3 , and treated with EtOH to ppt. another Ca salt (IV). The filtrate from this had 1 g. of reducing sugar. 5 g. of III was treated likewise with 2% H_2SO_4 at 128-32° for 2 hrs. and another Ca salt (V) was obtained together with 2.5 g. of reducing sugar and other acids of unknown nature. These salts are like the others, being white amorphous powders, sol. in H_2O to non-viscous solns. and these reduce Fehling soln. M. A. V.

Configurational relationships of the sugars, hydroxy acids, amino acids and halogen acids. P. A. LEVENE. *Chem. Rev.* 2, 179-216 (1925). - Review, with some 45 references.

C. A. R.

The tetrachloronitrobenzenes, the tetrachlorodinitrobenzenes; their reaction with sodium methylate. V. S. F. BERCKMANS AND A. F. HOLLEMAN. *Rec. trav. chim.* 44, 851-60; *Anales soc. espñ. fis. quim.* 23, 358-71 (1925) — 1,2,3,5,6- $\text{NO}_2\text{C}_6\text{HCl}_4$ (I) was prepd. (Beilstein, Kurbatov, *Ann.* 192, 236 (1878)) by nitration of $\text{C}_6\text{H}_2\text{Cl}_4$ (20 g.) (10.8 g.) was added to a mixt. of 100 g. HNO_3 (d. 1.52) and 100 g. 25% fuming H_2SO_4 and boiled 5-6 hrs. under a condenser. On cooling and pouring into H_2O 1,4-dinitro-2,3,5,6-tetrachlorobenzene (II), colorless, m. 227-8°, seps. 1,2,4,6- $\text{C}_6\text{H}_2\text{Cl}_4$ (20 g.) in 60 cc. HNO_3 (d. 1.52) was boiled gently 0.5 hr. The oil crystd. and when purified from EtOH gave 3-nitro-1,2,4,6-tetrachlorobenzene (III), m. 40-1° (obtained in impure form by B. and K., *loc. cit.*). Three synthetic methods for prepg. III are described in detail. 1,5-Dinitro-2,3,4,6-tetrachlorobenzene (IV) was prepd. (Jackson, Carlton, *Ber.* 35, 3855 (1902)) by nitrating 1,3,4,5- $\text{C}_6\text{H}_2\text{Cl}_4$. 5-Nitro-1,2,3,4-tetrachlorobenzene (V) was prepd. by nitrating 1,2,3,4- $\text{C}_6\text{H}_2\text{Cl}_4$ (B. and K., *loc. cit.*). V was also synthesized from 2,5- $\text{Cl}_2\text{C}_6\text{H}_3\text{NHAc}$ by a method that is given in detail. One g. V in 10 cc. of a mixt. of equal vols. of concd. H_2SO_4 and HNO_3 (d. 1.52) were boiled 2 hrs. The mixt. is poured in H_2O and seps. 5,6-dinitro-1,2,3,4-tetrachlorobenzene (VI), m. 151°. Nitro-pentachlorobenzene (VII) was prepd. according to Jungfleisch (*Jahresber.* 1868, 353). I (261 g.) in 105 cc. 0.1 N NaOMe was heated 8 hrs. on the H_2O bath and gave 2,3,5,6-tetrachloroanisole, m. 89-90°. This is the only product formed: the 4 Cl atoms rendered the NO_2 mobile. 3.06 g. II treated similarly gave 2,3,5,6-tetrachloro-4-nitroanisole, m. 105-6°. III (3 g.) and 57.2 cc. 0.207 N NaOMe heated 6 hrs. on the H_2O bath gave a mixt. of chloronitroanisoles. VI heated 10 hrs. with 3% excess NaOMe was mostly recovered unchanged; some Cl was replaced. V heated with 0.1 N NaOMe for 8 hrs. gave an oily mixt. of 2 isomers that could not be sepd. VI reacts with 0.1

N NaOMe at room temp.; both Cl and NO₂ are replaced; the reaction is complex and no pure products were isolated. When VII is boiled 8 hrs. with 0.1 *N* NaOMe both Cl and NO₂ are replaced and pentachloroanisole, m. 104–5°, was easily isolated. E. J. W.

The action of ketene on hydroxybenzoic acids and their esters. J. VAN ALPHEN. *Rec. trav. chim.* **44**, 838–40(1925).—While ketene does not react with PhOH (v. A., *Rec. trav. chim.* **43**, 861(1924)), it reacts easily with *o*-HOC₆H₄CO₂H and also, although more slowly, with *p*-HOC₆H₄CO₂H, *o*-HOC₆H₄CO₂Me, *m*-HOC₆H₄CO₂Et but not with *m*-HOC₆H₄CO₂H and *p*-HOC₆H₄CO₂Et. This reaction is an easy method of prep. acetylsalicylic acid (aspirin) when ketene is available. That the esters of *o*- and *m*-HOC₆H₄CO₂H react with ketene and that of the *p*-deriv. does not, is an exception to the general rule that *o*- and *p*-compds. are similar to each other in their reactions, while the compd. reacts otherwise.

E. J. WITZEMANN

The *cis*- and *trans*-1,3-cyclohexanedicarboxylic acid. The decomposition of the *trans*-acid into optically active constituents. J. BÖESEKEN AND A. E. J. PEEK. *Rec. trav. chim.* **44**, 841–50(1925).—Previous work on the behavior of polyacids, especially cyclic 1,2-diols, toward H₃BO₃ and Me₂CO showed that in satd. rings of 6 atoms these atoms do not lie in the same plane. Work on the heats of combustion of ring systems with more than 5 atoms have not confirmed Baeyer's tension theory. The conception of Sachse (*Ber.* **23**, 1363(1890)) of a mobile mol. is revived. By arguments previously given (B., *C. A.* **16**, 906) based on the formation of Me₂CO compds. with 1,2-diols even in cases in which the OH group is not situated favorably, B. has found that cyclic mol's. having more than 5 atoms have undulating and oscillating surfaces and that this mobility may be the reason why the isomers possible according to Sachse have not been isolated. B. and P. undertook to sep. these 2 possible isomers in the case of 1,3-hexahydrosophthalic acids (I) because the CO₂H group in general gives stability to mol's. Sachse's hexagon provides for 3 isomers of I. In the literature only the *cis*-(II) (m. 163°) and *trans*-(III) (m. 148°) forms are known; these were prep. according to Perkin and Goodwin (*J. Chem. Soc.* **87**, 846(1905)). After some preliminary attempts III was sep'd. into 2 isomers as follows: To 9.152 g III in 200 cc. boiling EtOH 8.950 g. strychnine was added. The soln. was evapd. to 150 cc and cooled. The crystals were sep'd. and recrystd. from EtOH. The salt (4.56 g) was decompd. with NH₃, extd. with CHCl₃ to remove strychnine, and on evapn gave about 2.0 g. of the free acid. An additional fraction (2.86 g.) was sep'd. The mother liquor was also freed from strychnine. Both the *d*- and *l*-isomers of III, m. 134°; [α]_D²⁵ 23°46' and –23°10'; soly. of the *d* acid 43.1 g. per l. at 25°; soly. of the *dl*-acid 13.26 g. per l. at 25°. The cryst. form of the active forms and the *dl*-forms are also quite different. The ionization const. of the *dl*-form is $K_{trans}^{25} = 3.45 \times 10^{-5}$. II could not be sep'd. into 2 isomers with strychnine; soly. of II 22.3 g. per l. at 25°; $K_{cis}^{25} = 5.34 \times 10^{-5}$.

E. J. W.

Gitonin and its degradation products. A. WINDAUS AND O. LINSERT. *Z. physiol. Chem.* **147**, 275–85(1925).—When gitogenic acid (I) is oxidized with hot concd. HNO₃, 1 C-atoms are removed from the side chain and an acid C₂₂H₃₂O₆ (II), m. 238° is obtained in 30% yield. This is probably a lower homolog of I, and contains 2 CO₂H and a lactone group. In cold solns it is dibasic, in hot solns. tribasic. *Et ester*, m. 131°, *mono Et ester*, m. 175°. By boiling II with Ac₂O and then distg. *in vacuo* a ketone C₂₁H₃₀O₃ (III), m. 226°, b₃ 280° was obtained in 60% yield; oxime, m. 250° (decompn.). Reduction of III in Ac₂O with H and Pt gave a hydroxylactone C₂₁H₃₂O₃ (IV), m. 194°, in approx. quant. yield. *Acetyl deriv.*, m. 197°, in 80% yield by refluxing IV with Ac₂O and NaOAc. Oxidation of IV by heating on a water bath with AcOH and HNO₃ (sp. gr. 1.52) and then dilg. with H₂O gave a 60% yield of an acid C₂₁H₃₀O₆, dibasic in cold, tribasic in hot soln. *Me ester*, m. 156° by esterification with CH₂N₂. Oxidation of I with CrO₃ gave a tribasic acid C₂₀H₂₈O₈ V, m. 217–20°. *Me ester*, m. 85–6°. By oxidation of V with HNO₃ (sp. gr. 1.48) a tribasic acid C₂₁H₃₀O₇, m. 297° (decompn.) was obtained. *Me ester*, m. 125°.

A. W. DOX

Rotenone, an active constituent of derris root (*Derris elliptica* Bergh). S. TAKEI. *Biochem. Z.* **157**, 1–15(1925).—By extrn. of derris root with alc. or Et₂O a substance, (I), C₁₉H₁₈O₆, m. 163°, and identical with *tubotoxin*, was obtained. It reduced Fehling soln. Phenylhydrazone, m. 243–5°. By the action of concd. H₂SO₄ on I, an isomer was obtained as needles, m. 177–8°. In contrast to I, this substance was not toxic to rats. I with alc. KOH gave needles (II), m. 128–9°, of the compn. C₁₀H₁₀O₃ (?). II fused with KOH gave *rotenic acid* (III), C₉H₁₀O₃, m. 182°, a hydroxymesitylenic acid. Concd. HNO₃ on III gave a nitro compd. C₉H₉O₃NO₂, m. 168°. I with HCrO₄ and AcOH or Ac₂O gave needles, C₁₈H₁₆O₆, m. 232–3°. This also reduced Fehling soln. I when heated with H₂CrO₄ and AcOH gave *rotenonone* (IV), C₁₇H₁₄O₆, m. 298°. Alc. KOH

on IV gave an acid $C_{17}H_{16}O_6$, m. 250° , which showed IV to be a lactone. By reduction of IV with Zn and AcOH, there was obtained a substance $C_{17}H_{16}O_6$, m. 198° . W. D. L.

Alleged formation of carbon, starting from piperonyl derivatives. PAUL PASCAL. *Bull. soc. chim.* 37, 1043-5(1925).—Fittig's and Remsen's supposed C, formed when piperonal is heated with dil. HCl at 200° (*Ann.* 168, 96(1873)), is really a resin formed by a "bakelization" process from the HCHO and diphenol resulting from the hydrolysis of the aldehyde. The yield of the supposed C is always at least 30-35% (calcd. from the equation given by F. and R., 8%), and by heating the reaction mixt. in sealed tubes at progressively increasing temps. or for increasing lengths of time at a const. temp., a continuous transformation of the aldehyde may be observed; originally a colorless mobile liquid, it becomes progressively darker and more viscous and its soly. diminishes, but there is never any sepn. of C, even as a fine suspension. C. A. R.

Semicarbazide-semicarbazones and thiocarbazones of cyclohexenones. I. MATZUREVICH. *J. Russ. Phys.-Chem. Soc.* 56, 19-44(1925); cf. C. A. 8, 1420.—Having obtained for the 1st time products of the union of semicarbazide (I) with semicarbazones of hydroaromatic ketones, viz. of cyclohexenones in which the double link is in the kernel, M. undertook to study the effect of different radicals of cyclohexenones and of the structure of hydroaromatic ketones on the prepn. and stability of semicarbazide-semicarbazones. Action of 1 mol. of I on 3-methyl-5-furyl- Δ^2 -keto-R-hexene (b. $163-6^\circ$): 1.3 g. of I.HCl and 1.6 g. AcONa in H_2O was added to 2 g. of the ketone in aq. alc. In about 1.5 hrs. the mixt. turned into a mass of crystals of the formula $C_{13}H_{16}N_4O_2$, which decomp. $175.5-77^\circ$. Action of 2 mols. of I on 3-methyl-5-furyl- Δ^2 -keto-R-hexene: 2.7 g. I.HCl and 3.2 g. AcONa in a small amt. of water was poured into 2 g. methylfurylcyclohexenone in 40 cc. 50% alc. In 1.5 hrs. the mixt. turned into a cryst. mass which was left standing at room temp. for 3 weeks, then the crystals were washed first with hot water then with boiling alc. The latter dissolved a large quantity of crystals identical with those of the previous expt., whereas the substance remaining undissolved had the compn. $C_{13}H_{20}O_2N_4$ and decompd. $197-8.5^\circ$. Formation of the semicarbazide-semicarbazone of 3-methyl-5-phenyl-keto-R-hexene (b. $119-26^\circ$): 2 g. of the ketone and 3.3 g. AcONa in 20 cc. water and 25 cc. alc. were left at room temp. for 2 months. The crystals which were formed were washed with hot water, with alc. and with ether. The residue consisting of a white powder decompg. $201-2^\circ$ was the semicarbazide-semicarbazone of the ketone. The above expts. show that the presence of aromatic and heterocyclic radicals contg. O does not interfere with the addn. of I at the point of the double link and the reaction takes place normally. When, however, hydroaromatic ketones have a different structure, viz. when the double link is in a side chain, as in the case of pulegone, or when a 2nd double link is present in the kernel, as in the case of carvone, then the double link is inactive towards I. With carvone M. obtained the semicarbazone of *d*-carvone (*Ber.* 39, 681, 2113), with com. pulegone, $(NHCONH_2)_2$. Attempts to obtain semicarbazide-semicarbazones with benzoylacetone and benzoylpinacoln also failed. In view of the analogy between I and thiosemicarbazide M. investigated whether the latter furnishes compds. analogous to semicarbazide-semicarbazones. He found that instead of thiosemicarbazide-thiosemicarbazones only the corresponding thiocarbazones are obtainable. All the thiosemicarbazones obtained were well crystd. and possessed a very bitter taste. Action of acids on semicarbazide-semicarbazones: Dil. acids both org. and inorg., are the only good solvents of semicarbazide-semicarbazones, but the soln. is accompanied by a decompn. which takes place even in the cold: I is split off and semicarbazones of cyclohexenones are obtained. HNO_2 does not give NO derivs. of semicarbazide-semicarbazones of cyclohexenones but destroys them while splitting off the ketones. As to the action of HCN, M. expected either the union of 2 mols. of HCN to the semicarbazones or the union of 1 mol. HCN with the semicarbazide-semicarbazones, but obtained only the usual products of decompn. of semicarbazide-semicarbazones by dil. acids. The action of HCl gas on semicarbazide-semicarbazones suspended in abs. alc. leads to the formation of di-HCl salts; sometimes a 3rd mol. HCl unites to the semicarbazide-semicarbazone and this union probably takes place at the point of the double link of the C:O group, which is united with the semicarbazide rest. Semicarbazide-semicarbazones are sol. in boiling water partly without decompn. and partly with decompn. into I and semicarbazone, the latter gradually decompg. in its turn into the ketone or I or azine. Boiling alkalis rapidly decomp. semicarbazide-semicarbazones with formation of the corresponding ketones and tarry products. High temps. completely destroy semicarbazide-semicarbazones with formation of NH_3 , tars and, probably, $(NHCONH_2)_2$. BERNARD NELSON

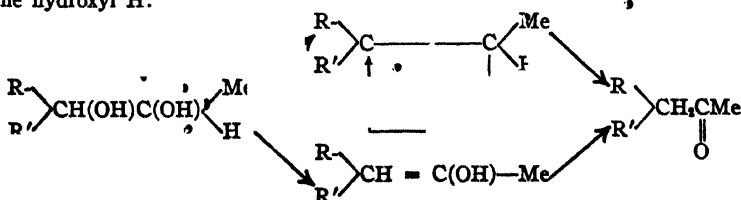
Phenylcarbaminic hydrazones of cyclohexenones. I. MATZUREVICH. *J. Russ. Phys.-Chem. Soc.* 56, 45-53(1925).—Researches of Borsche and Merkwitz (*Ber.* 34,

429; 37, 3177; 38, 831) on the reactions which take place between primary amines and the semicarbazones of fatty, aromatic and hydroaromatic aldehydes and ketones have shown that the intermediate products of these reactions consist of NH_2 and phenylcarbaminic hydrazones of the ketones or the aldehydes and that these hydrazones are finally transformed into azines. By analogy it could be expected that semicarbazones of cyclohexenones, when reacting with aniline, would form unstable hydrazones which would decomp. into azines and hydrazines; semicarbazide-semicarbazones of cyclohexenones were expected to react with aniline in the same way, since they decomp. at high temps. into semicarbazones. M. carried out several expts. with semicarbazones and semicarbazide-semicarbazones of cyclohexenones to det. whether these compds. react with aniline conforming to the above suppositions. He boiled aniline with the semicarbazones of methyl-, dimethyl- and methylethylcyclohexenone and the semicarbazide-semicarbazones of mesityl oxide, methyl-, dimethyl- methylethyl- and methylisopropylcyclohexenone and obtained in every case the corresponding phenylsemicarbazones crystallizable from alc., which may be used, like the semicarbazones, to characterize cyclohexenones. M. concludes that on boiling for a short time semicarbazones or semicarbazide-semicarbazones of cyclohexenones with aniline NH_2 and phenylcarbaminic hydrazones of cyclohexenones are actually obtained, but that these hydrazones do not decomp. into azines and hydrazines. These results are in agreement with Borsche's statement (*Ber.* 34, 4297) that in the case of semicarbazones of ketones the reaction with amines usually stops at the 1st phase. BERNARD NELSON

Action of aromatic amines on semicarbazide hydrochloride. I. MATZUREVICH. *J. Russ. Phys.-Chem. Soc.* 56, 55-60 (1925).—Among the products of reaction obtained on heating aniline with semicarbazide-semicarbazones (cf. preceding abstr.) M. found $\text{CO}(\text{NHPh})_2$ (I). Assuming that the formation of I was due to the action of aniline on semicarbazide (II) split off during the reaction, M. proceeded to verify this assumption by heating II.HCl with aniline and with other primary amines and in every case obtained sym. derivs. of urea. The reaction apparently takes place in 2 phases according to the following equations: $\text{RNH}_2 + \text{II} = \text{NH}_2\text{NHCONHR} + \text{NH}_3$, $\text{NH}_2\text{NHCONHR} + \text{RNH}_2 = \text{RNHCONHR} + \text{NH}_2\text{NH}_2$. 2 g. II.HCl and an excess of aniline were boiled 1 hr., after which the excess of aniline was driven off with steam and the residue washed with hot water and repeatedly recrystd. from alc. The crystals consisted of I. *o*- and *p*-Toluidine, xylidine and PhCH_2NH_2 gave the corresponding diarylureas. The reactions between II.HCl and *p*- $\text{H}_2\text{NC}_6\text{H}_4\text{COMe}$ or *p*-bromoaniline are more complicated and have not yet been studied by M. BERNARD NELSON

A hypothesis on the biological origin of resin acids. OSSIAN ASCHAN. *Chem.-Ztg.* 49, 689-91 (1925); cf. *C. A.* 15, 3096; 17, 1228; 18, 2151.—The formulas of terpenes, polyterpenes and resin acids are all multiples of isoprene, C_5H_8 . Their formation from this common building stone by the action of enzymes appears more probable than the formation of resin acids by oxidation of terpenes. The rubber production by tropical plants and the presence of isoprene, isoamylene and isopentane in masut suggest that isoprene is a widely spread plant metabolite in all latitudes as well as in the prehistoric epoch. The following is the hypothetical formation of isoprene (I) and vinylacrylic acid (II) from the normal intermediates of enzymic carbohydrate decomp.: Acetone, dihydroxyacetone and pyruvic acid condense with AcH to aldols, which after their reduction to the glycols split off water. The condensation of 2-4 mols. I leads to all the mono- and di-terpenes of the *Pinus* species (abietin, pinabietin, colophene). The condensation of 3 mols. I with 1 mol. II yields a hypothetical abietic acid, the structure of which resembles closely that of Virtannen's pinabietic acids. MARY JACOBSEN

Comparison of the readiness of migration of hydrogen and of some acyclic radicals. (MLLE.) J. LEVY and ROGER LAGRAVE. *Compt. rend.* 180, 1032-4 (1925).—In the rearrangement of unsym. glycols of the type $\text{RR}'\text{CH}(\text{OH})\text{CH}(\text{OH})\text{Me}$ it is not usually possible to decide whether H migrates after the intermediate formation of an ethylene oxide or whether a simple dehydration to a vinyl alc. occurs, followed by a migration of the hydroxyl H:



The radicals may also migrate in some cases. Hence L. and L. prepd. 2 ethylene oxides where no vinyl alc. deriv. can be formed. In oxides of the above type if H migrates, a ketone will be formed and if 1 of the radicals migrates, an aldehyde will be formed. The oxides were prepd. by the action of BzO_2H on the corresponding ethylenes. 1,1-Diphenylpropene 1-oxide, b_{11} 178–80°, m. 34°, and isomerizes by slow distn. at atm. pressure solely to a ketone 1,1-diphenylacetone, whose semicarbazone m. 165–6°. 1,1-Diphenylbutene 1-oxide, b_{18} 170–5°, gave a mixt. of 1,1-diphenyl-2-butanone, (semicarbazone, m. 194–5°) and diphenylethylacetaldehyde (semicarbazone, m. 175–6°), but chiefly the ketone. Hence in the 1st case only the H migrates but in the 2nd both the H and the Et group migrate.

M. A. Yourtz

Some derivatives of indandione and of biindone. I. Mechanism of the condensation of indandione with aldehydes. DAN RADULESCU AND VICTOR GEORGESCU. *Bull. soc. chim.* 37, 1069–78(1925); cf. C. A. 19, 494.—The reaction between indandione, $\text{C}_6\text{H}_4(\text{CO})_2\text{CH}_2$ (I), and aldehydes, RCHO , varies with the nature of R and of the condensing agent, the final product depending on the relative velocities of the 6 following reactions: $\text{I} + \text{RCHO} \rightarrow \text{C}_6\text{H}_4(\text{CO})_2\text{C}(\text{CHR})$ (II); $\text{I} + \text{II} \rightarrow [\text{C}_6\text{H}_4(\text{CO})_2\text{CH}]_2\text{CHR}$ (III); $\text{II} + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_4(\text{CO})_2\text{CHCH}(\text{OH})\text{R}$ (IV); $2\text{II} \rightarrow \text{C}_6\text{H}_4(\text{CO})_2\text{C}(\text{C}_6\text{H}_4\text{COCH}_2$

(V); $\text{V} + \text{RCHO} \rightarrow \text{C}_6\text{H}_4(\text{CO})_2\text{C}(\text{C}_6\text{H}_4\text{CO})_2\text{CHR}$ (VI); $\text{II} + \text{V} + \text{C}_6\text{H}_4(\text{CO})_2\text{CHCHRCHCO} \rightarrow \text{C}_6\text{H}_4\text{C}(\text{CO})_2\text{C}_6\text{H}_4$ (VII). II (R = Ph), yellow, m. 153°,

is best obtained (70–5% yield) by the method described in the earlier paper from I, BzH and glacial AcOH. Phenylindandionylmethanol (IV, R = Ph), obtained almost quant. from I and BzH with alc. KOH, m. 158°, mol. wt. in freezing C_6H_6 222.1–273.9, slowly loses H_2O in boiling C_6H_6 , PhMe, etc., with formation of II (which is formed quant. in AcOH with H_2SO_4). IV is also obtained as the red KOH salt from II with 1 equiv. KOH in abs. alc.; its phenylurethan, m. 154–5°, dissolves in alkalis with yellow color. The salts of the *m*- NO_2 analog of IV (R = $\text{C}_6\text{H}_3\text{NO}_2$) can be obtained as highly colored crystals but the free carbinol at once loses H_2O and forms the yellow II (R = $\text{C}_6\text{H}_3\text{NO}_2$), m. 246°. Methylenebisindandione (III, R = H), from I, 3 times the calcd. amt. of 20% HCHO and 1 mol. 50% KOH, m. 201–2°, gradually becomes pink in the air, dissolves in alkalis with yellow color; di-Na salt, brick-red; Ba salt, orange-yellow. With PhNH-NH_2 in MeOH III forms a yellow hydrazine, $\text{CH}_2[\text{C}(\text{C}(\text{NHNHPh})\text{C}_6\text{H}_4\text{CO})_2]$, m.

215–6°, which reduces Fehling soln and Ag salts; with $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$ is obtained a hydrazonium salt, $\text{CH}_2[\text{C}(\text{C}(\text{ON}_2\text{H}_5)\text{C}_6\text{H}_4\text{CO})_2]$, yellow, m. 181–2°, and with NH_4OH

a mixt. of tri- and tetroximes, m. 235°, explodes at slightly higher temps. Ethylidene bisindandione (15–20% from I and 0.75 mol. AcH in C_6H_6), slightly pink microcryst. powder, m. 226–7°; tetroxime, yellowish, m. 243–5°, decomp. violently at a slightly higher temp. Acetonylidenebisindandione (0.15 g. from 3 g. I and 1.5 g. Me_2CO with alc. KOH), yellowish white cryst. powder, m. 118–9°.

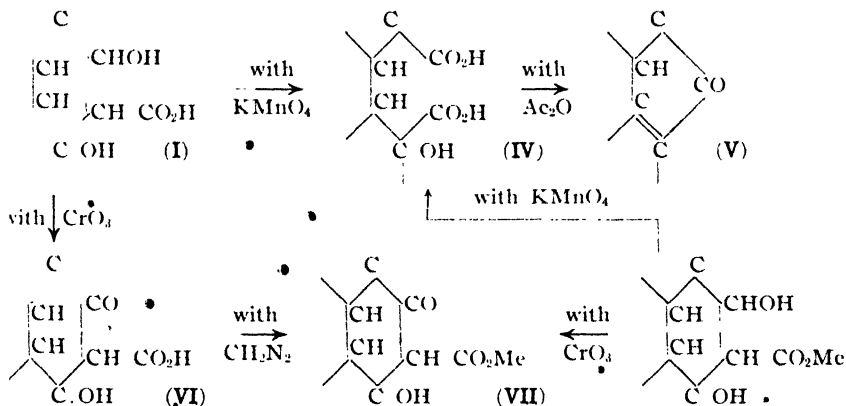
C. A. R.

Preparation of isonuclear bromonitronaphthalenes from the corresponding tetralin derivatives. V. VESELY AND L. K. CHUDOZILOV. *Chem. Listy* 19, 260–4(1925); cf. C. A. 18, 681.—Dehydrogenation of bromotetralins leads to the corresponding bromonaphthalenes. To effect the reaction the bromotetralin is treated with Br_2 at 100° until vigorous evolution of HBr stops; the temp. is then raised to 200° during 1 hr. The substance is afterwards crystd. from alc. In this manner V. and C. succeeded in prep. the following $\text{C}_{10}\text{H}_6(\text{NO}_2)_2\text{Br}$: 1,2, m. 98–100°; 2,1, m. 98–9°; 3,2, m. 82–3°; 3,1, m. 128–9°; 1,3, m. 97–8°; 2,4,1- $\text{C}_{10}\text{H}_5(\text{NO}_2)_2\text{Br}$, m. 151–2°; 1,3,2-isomer, m. 183–4°.

FRANK C. KRACEK

The saponins and related compounds. XIV. Further studies on the structure of hederagenin and an example of steric hindrance in it. A. W. VAN DER HAAR. *Rec. trav. chim.* 44, 749–57(1925); cf. C. A. 19, 73–4.—In the last paper on hederagenin (I) (C. A. 16, 3639) the results of a comparative study of I and other saponogens with cholesterol, sitosterol and phytosterol-like compds. showed, according to the Liebermann cholesterol reaction and their behavior on distillation with Zn dust in H_2 , that these compds. possess analogies. In this paper another analogy is developed. In previous papers (C. A. 16, 1749, 1750, 3639) it was shown that I has 1 CO_2H and 2 OH groups and 1 of the latter is under the influence of the CO_2H group since after acetylation the Ac group is lost in recrystg. the product from EtOH. If the CO_2H is previously esterified then the di-Ac deriv. is recrystd. unchanged from EtOH. This indicates that 1 of the OH groups is tertiary and close to the CO_2H group. This conforms with the

fact that when **I** is oxidized with CrO_3 the OH group is not attacked. This behavior is not restricted to **I** but is apparently characteristic of the saponogenins and allied compds.: araligenin (**II**) (C. A. 17, 988) and ursolic acid (urson) (**III**) (C. A. 18, 2511) behave similarly. This steric hindrance was more closely investigated with **I**. The CO_2H of **I** which is easily esterified with MeI , Me_2SO_4 and CH_2N_2 remains unchanged with 3% HCl gas in abs. MeOH (Fischer-Speier method). The Me ester obtained in such cases is resistant to KOH . The Et ester of **I** is in fact not acted upon by 1.0 N KOH - EtOH on boiling 1 hr. and only 15.8% is sapond. by boiling 7 hrs. Similar hindrance in the sapon. of the Me esters of **II** and **III** was previously observed (*l. c.*). Whether this hindrance is regarded as spatial or a matter of polarity the facts are of importance in detg. the constitution of **I**. They indicate that the 2 OH groups are *o*- to the CO_2H group. The previous work showed that Zn dust distillation was too vigorous a reaction to be of aid in detg. the constitution of **I**. Milder reagents were required. Oxidation with KMnO_4 in alk. aq. soln. and with CrO_3 in AcOH was used. 5 g. **I** + 10 g. KOH dissolved in H_2O were treated gradually in the course of weeks with 12 g. KMnO_4 . A monohydroxy-dicarboxylic acid (hederagenolic acid (**IV**), $\text{C}_{29}\text{H}_{48}(\text{OH})(\text{CO}_2\text{H})_2$, m. 230° , was obtained in 80% yield; strongly hemolytic, foams in H_2O , sublimes about 150° at 16 cm. (the sublimate, m. 130°), contains no double bond, aldehyde or CO group. **IV** resembles acids obtained by oxidation of cholesterol (Diels, Abderhalden, *Ber.* 36, 3177(1903); Windaus, C. A. 2, 1558; Faust, *Arch. exper. Pathol.* 64, 244(1909); Flury, C. A. 6, 396; etc.) **IV** treated with Ac_2O (Blanc, C. A. 2, 2949) gives heteragenone (**V**) $\text{C}_{29}\text{H}_{44}\text{O}$, mol. wt. 403 (in camphor): *i. e.* $\text{IV} \rightarrow \text{V} + \text{CO}_2 + 2\text{H}_2\text{O}$. The oxidation of **I** to **V** takes place thus: $\text{C}_{31}\text{H}_{50}\text{O}_4 + 4\text{O} \rightarrow \text{IV} + \text{CO}_2 + \text{H}_2\text{O}$. **I** is satd. (C. A. 16, 1750), **IV** contains no ordinary double bonds, but **V** is an unsatd. compd. for it decolorizes KMnO_4 in AcOH soln. and adds Br_2 . Three g. **I** in 200 cc. glacial AcOH + 3.5 g. K bisulfate were treated gradually with 0.900 g. CrO_3 in a little H_2O + more AcOH . After 24 hrs. much H_2O was added, the ppt. was filtered off, washed and dried. The acid was dissolved in glacial AcOH , the hot soln. was dild. to 80% with H_2O . This was repeated until Cr was removed. The heteragenonic acid (**VI**) $\text{C}_{31}\text{H}_{48}\text{O}_4$ (a ketomono-hydroxycarboxylic acid) obtained m. 292° ; semicarbazone of **VI**, m. 260° . With CH_2N_2 **VI** gives a cryst. Me ester **VII** m. 192° ; **VI** itself tends to form gels. The Me ester of **I** treated with CrO_3 as above gave **VII**, m. 192° . The tertiary OH group of **I** is present in **VI** and **VII**. The facts developed are represented in the following scheme which



is discussed fully in the original. **I**, **IV** and **V** like naphthalene derivs. give the fluorescence reaction with resorcinol. Energetic oxidation of **I** with strong HNO_3 gave *asym*-dimethylsuccinic acid, m. 132° . The structure of the rest of the mol. of **I** is still unknown and will be detd. from a study of **V** and **VI**. E. J. WITZEMANN

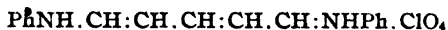
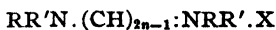
Lignin. K. KÜRSCHNER. *Brennstoff-Chem.* 6, 117-25, 177-80, 188-94(1923).—Various methods of prepn. of pure lignin from wood are discussed. Methods based on the recovery of lignin from sulfite solns. obtained in pulp-making are worthless because the lignin so brought into soln. has suffered far-reaching decompn. Remove resins from 10 g. sawdust with $\text{EtOH}-\text{C}_6\text{H}_6$ (1:1), and treat the residue with 400 cc. fuming HCl , (d₁₅ 1.212-1.223), for 15 min. with const. stirring. Pour the mixt. into 3 l. water, whereupon the lignin settles and the hydrocellulose floats and sepn. can be effected. Wash

the lignin and, since it still contains cellulose, repeat the treatment with HCl until on washing the liquid runs through clear. The purity of the product is further tested by detn. of pentosans (fural detn.), which should be absent, and by the reducing action on a photographic plate characteristic of lignin. Lignin is probably a mixt. of closely related compds. The presence of radicals OH, OMe, OAc, CHO₂, said to characterize the lignin complex does not necessarily indicate lignin, since other substances associated with it have these groups and so far no one has prepd. pure lignin with certainty. The color reactions likewise are not necessarily specific. Many attempts have been made, but without success, to prove lignin mainly of aromatic structure. Authorities differ as to its structure and the various formulas proposed are worthless. Coniferin and vanillin have repeatedly been reported present in lignin, the latter in small quantities. By heating lignin to 200° in an oxidizing atm. vanillic acid was formed, which could be collected as a sublimate and detd. The amts. found were 55.2, 60.0 and 58.7% of the lignin treated. Since the tannins yield a sublimate of tannic acid by similar treatment and the tannins are glucosides, K. thinks lignin is a glucoside, probably polymerized coniferin. Furthermore, the residues from sublimation treatment of lignin are caramel-like mixts. as one might expect of decompn. products of glucose. J. D. DAVIS

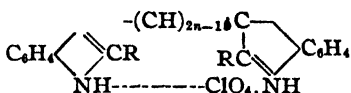
Autoxidation and antioxiidizing action. XVI. The catalytic property is localized in the oxidizable part of the molecule. CH. MOURVU, CH. DUFRASSE AND P. LOTTE. *Compt. rend.* 180, 993-8(1925); cf. *C. A.* 19, 1127.—Previous work has established that practically all catalyzers of autoxidation (either favoring or retarding oxidation by O) are easily oxidizable substances. Also they usually contain the groups —OH (phenolic), I, or S. To test whether the action is localized in these groups they can be modified and the resulting compd. tested; e. g. Me ethers of phenols are almost inactive. In the expts. here described, furfural was subjected to an atm. of O in a closed system, with and without the catalyst or anticatalyst. Pure furfural was almost completely oxidized in 20 days. With 1% of Me₂S, Et₂S, or Pr₂S present, the oxidation was less than 3%. Me₂C(SEt)₂ reduced the oxidation to about 10%. However, when sulfones or sulfoxides were used (Et₂SO₂, Ph₂SO₂, Ph₂SO, sulfonal and trional) the oxidation was practically unaffected. On acrolein, however, Me₂S and Et₂S act as positive catalysts while Me₂C(SEt)₂ is a strong negative catalyst. Me₂SO₂ and Et₂SO₂ slightly retard the action while sulfonal and trional are inactive. Hence it is believed that the seat of the catalytic power of simple aliphatic or aromatic sulfides is in the S atom, and connected with its oxidizability, since sulfones, which are completely oxidized, are inactive. M. A. YOURTZ

"Vinylene-homologous" indole and pyrrole dyes. W. KÖNIG. *Z. angew. Chem.* 38, 743-8(1925).—In the present paper are described a few observations which have been made in the course of a study of the shiftings of the light absorption and the frequently parallel increase in dye properties which are produced by the streptostatic introduction of vinylene groups into a conjugated system. The substances considered are specially polymethine dyes of the general type I which may be either of the pure strepto-polymethine type (e. g. II) or of the heterocyclopolymethine type (III). Below are given, for a no. of these dyes, the color they impart to tannated cotton (in terms of the Ostwald color scale) and the absorption max., in μ , of their alc. solns. (main band printed black). II, 20, 492; IV (III, R = H, $n = 1$), 27, 532, 482; V (III, R = Me, $n = 1$), 18, 482, 350, 290; VI (III, R = Me, $n = 2$), 38, 555, 400, 340; VII (III, R = Me, $n = 3$), 58, 658, 400, 360; VIII (IX, R = H, $n = 2$), —, 526, 486; X (IX, R = Me, $n = 1$), —, 482, 370, 300; XI (IX, R = Me, $n = 2$), —, 560, 395, 320; XII (IX, R = Me, $n = 3$), —, 677, 405, 330; XIII, 30, 518; XIV, —, 526; XV ($n = 1$), 8, 464; XV ($n = 2$), 46, 567; XV ($n = 1$), blue, 663; XVI ($n = 1$), —, 484; XVI ($n = 1$), —, 586. Passage from the pure strepto-polymethine dye I to IV produces a distinct bathochromic effect and the chief absorption band in I is resolved into 2 bands in IV. The dyes derived from methyl ketole (V-VII) show, as compared with IV and even with II, a not inconsiderable negative color-shift, and in them the 2 bands of IV are again united into 1; the progressive introduction of vinylene groups (V \rightarrow VI \rightarrow VII) has a positive color effect (as measured by the shifting of the main absorption band) of 73 μ and 103 μ , resp., and each such group corresponds to a jump of about 20 units on the Ostwald color scale. The complete absorption curves of these 3 "onium-halochromic" dyes, although relatively complex, show a very close family resemblance to each other and are extraordinarily similar in form and position to those of the corresponding "aci-halochromic" dyes X-XII. In naming these dyes it is suggested that the hypothetical mother substance (XVII) be called 3,3'-pyrroflavine; IV would then be 3,3'-bisindolepyrroflavinium perchlorate or 3,3'-indorhodinium perchlorate, and V-VII would be the strepto-mono-, di- and tri-vinylene derivs., resp. 3,3'-strepto-Vinylene-2,2'-dimethylindorhodinium perchlorate

(VI) (about 7 g. from 10 g. methylketole, 3.7 g. $\text{HC} : \text{CCH}(\text{OEt})_2$ and about 2 equivs. HClO_4 refluxed 1 hr.), dark crystals with green luster, sol. in warm alc. and PhNO_2 with violet color, deflagrates above 280° ; the chloride could not be obtained pure on account of its tendency to take up more HCl ; *bromide*; *anhydro base*, from the chloride or bromide with NH_4OH , finely cryst. dark brown mass, m. above 250° , sol. in org. solvents with orange-red color, shows in alc. an indefinite broad band at about 475μ , gives with NaOEt or concd. NaOH the crimson *Na salt* (XI), which shows sharp selective absorption. *3,3'-strepto-Vinylene-2,2',5,5'-tetramethylindorhodinium perchlorate*, from 2,5-dimethylindole, sol. in alc. with violet color, the max. absorption being at 560μ , gives with concd. NaOH a deep blue-red *Na salt* with max. absorption at about 564μ . *2,2'-strepto-Vinylene-3,5,3',5'-tetramethyl-4,4'-dicarbethoxypyroflavinium chloride* (XV, $n = 2$), from 1,3-dimethyl-2-carbethoxypyrrole in about 80% yield), partly hydrolyzed by H_2O , completely by NH_4OH , to the red-brown *anhydro base*, which is sol. in alc. with orange color (very indefinite band with a max. at about 490μ); *Na salt* (XVI, $n = 2$), pure violet. •

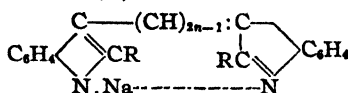


(I)

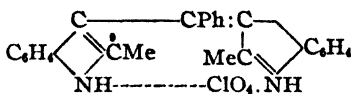


(III)

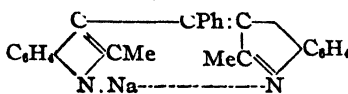
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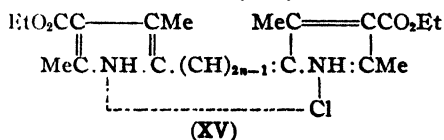
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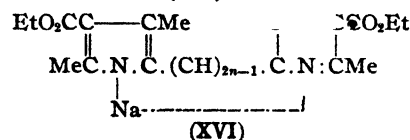
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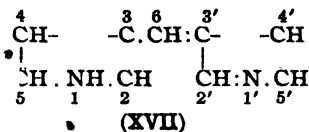
(XIV)



(XV)



(XVI)



(XVII)

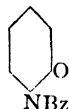
C. A. R.

Benzoylation of α -pyridone. A. E. CHICHIBABIN AND O. P. OPARINA. *J. Russ. Phys.-Chem. Soc.* 56, 153-6 (1925).—Benzoylation of the 2 tautomeric forms of α -pyridone (I) under various conditions furnished only one Bz deriv. Judging from the circumstance that this deriv. possessed distinctly basic properties it must be assumed that it is the benzoate (II) of hydroxypyridine and not the benzoylpyridone (III). The latter could not be obtained. Benzoylation of I was tried under the following 4 conditions: (1) to 4 g. I in a small quantity of water, were added first a large excess of NaOH , then a large excess of BzCl . The mixt. was shaken first at room temp., then with heating. • After satn. of the aq. soln. with soda, the insol. oil was extd. with ether, the Et_2O soln. dried, the ether evapd. and the residue distd. under 30 mm., whereupon the distillate passed entirely $180-90^\circ$. In order to purify the product it was treated with cold HCl which dissolved the Bz deriv. and left a residue of Bz_2O . The HCl soln. of the Bz deriv. was extd. with ether and the Et_2O soln., after standing in the desiccator, became congealed into a mass of crystals. (2) To 4 g. I was added the theoretical quantity of Bz_2O in abs. ether, the mixt. was refluxed on a water bath to complete soln. of the I, then the ether was evapd. and the residue was purified by soln. in HCl etc., as in the preceding expt. Yield 3.6 g. (3) Equiv. amts. of isopyridine and dry powd. BzONa were heated with a small quantity of Cu bronze at 250° for several hrs. After cooling, the mixt. was treated with water, satd. with soda and extd. with ether. The ether was evapd., the residue was distd. under 25 mm. and the $185-200^\circ$ fraction gave on standing crystals of the Bz deriv. (4) One mol. of dry pyridine-diazotate (cf. C. and Razantsev,

C. A. 10, 2898) was introduced in small portions and under cooling with snow into Bz_2O in anhyd. ether. An energetic evolution of N took place. The mixt. was left standing in snow for some time and then treated with dil. HCl . The Et_2O layer was sepd. with soda and extd. with ether. The ether being evapd., the soln., after a long time, sepd. crystals of the Bz deriv. **II**, m. 42° , b_{30} $183-6^\circ$, is very sol. in the usual org. solvents. On being mixed with water or pptd. from alc. with water it turns into an oil. It is easily saponifiable into BzOH and **I**. HCl solns. give in the cold with PtCl_4 the chloroplatinate $(\text{C}_{12}\text{H}_9\text{O}_2\text{N} \cdot \text{HCl})_2\text{PtCl}_4$, which m. 186° decompn.; this reaction does not take place in hot soln. Alc. **II** gives with picric acid in hot alc. the picrate $\text{C}_6\text{H}_5\text{NO} \cdot \text{C}_6\text{H}_2(\text{NO}_2)_3\text{OH}$.



(II)



NBz

(III)

BERNARD NELSON

The acid character of saccharin and related acids (KOLTHOFF) 2. The chemistry and chemotherapy of the tropane derivatives (DYSON) 11H. Acid catalysis in lactone formation (TAYLOR, CLOSE) 2. Mutarotation—The solution volumes and refraction constants of some polyhydric alcohols (RIIBER, *et al.*) 2. Alkyl compounds of Tl (KRAUSE, GROSSE) 6.

Hydroxybenzaldehydes. H. H. HODGSON and BRITISH DYESTUFFS CORPORATION, LTD. Brit. 232,392, March 19, 1924. Salicylaldehyde and *m*-hydroxybenzaldehyde are prepd. by reducing crude nitrated benzaldehyde with hyposulfite and, without boiling off the SO_2 , diazotizing and distg. the diazotized product in a current of steam. The *m*-compd. is extd. from the residue and the *o*-compd. from the distillate.

Metaldehyde. E. LUSCHER and T. LICHTENHAHN. U. S. 1,555,223, Sept. 29. In making metaldehyde from AcH , a small quantity of CaBr_2 is used as a catalyst.

Acetaldehyde. C. S. WILLIAMS. U. S. 1,555,539, Sept. 29. EtOH vapor is passed in contact with Cu which has been alloyed with another material such as Zn to prolong its life, which is maintained at a temp. at which it is active but durable (about 425° with an alloy of Cu with Zn 50%).

Higher condensation products of acetaldehyde. C. J. HERRLY. U. S. 1,549,833, Aug. 18. Condensation products substantially insol. in H_2O and adapted for use with alc., ether, acetone, aldol or other solvents in promoting froth-floatation of ores are made from AcH and aldol, *e. g.*, by condensation in the presence of H_2SO_4 . Cf. C. A. 19, 3356.

Butyraldehyde. C. BOGIN. U. S. 1,556,067, Oct. 6. The aldehyde is distd. in the presence of sufficient H_2O to form a constant-boiling mixt. with the aldehyde.

Sodium formate from carbon monoxide. M. ENDERLI. U. S. 1,555,796, Sept. 29. CO is caused to act at a high temp., preferably about $160-170^\circ$, upon a soln. of Na_2SO_4 the concn. of which is kept constantly low by the presence of solid basic Na Ca sulfate, solid $\text{Ca}(\text{OH})_2$ and solid CaSO_4 , the process being continued until concns. of formate are produced which are considerably higher than the concn. of the soln. in Na_2SO_4 .

Borneol. SOC. ALSACIENNE DE PRODUITS CHIMIQUES. Brit. 231,468, March 28, 1924. In the manuf. of borneol by treating pinene or camphene with an acid and hydrolyzing the resulting ester, acids are employed of the general formula $\text{COOH}-\text{R}-\text{CO}-\text{R}'$, in which R and R' represent aromatic nuclei, or their homologs or substitution products, *e. g.*, *o*-benzoylbenzoic acid, *o*-naphthoylbenzoic acid, 2,3-dichlorobenzoylbenzoic acid, 3,4-dichlorobenzoylbenzoic acid, tetrachlorobenzoylbenzoic acid, naphthoyltetrachlorobenzoylbenzoic acid, and their Br, I, nitro, Me, OH and alkoxyl derivs. The esters obtained are readily hydrolyzed with aq. NaOH .

Alcohols. R. B. MACMULLIN and R. E. GEGENHEIMER. U. S. 1,549,779, Aug. 18. MeOH or other alkyl chloride mixed with steam is passed over lime under high pressure to form the corresponding alc., *e. g.*, MeOH . A temp. of $350-450^\circ$ and pressure of 175-200 lbs. per sq. in. are suitable.

Methanol, etc. BADISCHE ANILIN & SODA FABRIK. Brit. 231,285, Feb. 8, 1924. App. for synthetic production of MeOH from CO and H is made of or coated with a metal or alloy which does not form carbonyl compds. and which is resistant to the temps. used, *e. g.*, Cu, Ag, Al and their alloys, special steels contg. substantial proportions of Cr, Mn, W, Mo or V such as "steel V2A," or the metals Cr, Mn, W, Mo

and V themselves; but Fe, Co and Ni are excluded. To protect the reaction tube against the action of hot H, it may be formed with a steel mantle with an inner wall of Cu or other suitable metal. Cf. C. A. 19, 3093.

Comminuting organic peroxides. T. KROEBER. U. S. 1,555,805, Sept. 29. In converting benzoyl peroxide or other org. peroxides from the cryst. to a finely divided condition without decompn., the material is ground with an inert liquid, e. g., H₂O.

Ether. E. MALLINCKRODT. Brit. 231,023, May 5, 1924. See U. S. 1,508,563 (C. A. 18, 3685).

Carbohydrates. L. LILIENFELD. Can. 248,229, Mar. 31, 1925. Undissolved cellulose material is treated with several times its wt. of caustic alkali in the presence of sufficient water to dissolve the alkali in a strong soln. and the product is treated with an etherifying agent.

Carbohydrate ether. L. LILIENFELD. Can. 248,226, Mar. 31, 1925. The carbohydrate is treated with an amt. of solid caustic alkali greater than can be dissolved in the liquid present and the mixt. is subjected to the action of an etherifying agent.

Carbohydrate ethers. L. LILIENFELD. Can. 248,228, Mar. 31, 1925. Cellulosic substances are impregnated with caustic alkali soln. and treated with an etherifying agent without removing the excess alkali.

Vinyl ethers and esters. CONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE, GES. Brit. 231,841, April 1, 1924. Vinyl ethers and esters are prepd. by the catalytic interaction of C₂H₂ with a compd. contg. a carboxyl or OH group (excluding chlorinated acetic acids), the vinyl compd. being removed as soon as formed to prevent its transformation into an ethyldene compd. The reaction is preferably carried out at a temp. below the b. p. of the mixt. and under reduced pressure. Vinyl acetate may be formed and distd. off from a warm mixt. of Hg sulfate and HOAc through which C₂H₂ is passed; and vinyl ether may be formed by passing C₂H₂ into abs. alc. and ligroin contg. Hg phosphate.

Benzyl esters of higher fatty acids. H. A. SHONLE and P. Q. ROW. U. S. 1,553,271, Sept. 8. Benzyl esters of fatty acids contg. 10 or more C atoms, e. g., benzyl stearate, m. 45.8°, are prepd. by treating the anhyd. Na salt of the acid with benzyl chloride.

Butyl esters of phthalic acid. E. E. REID. U. S. 1,554,032, Sept. 15. Dibutyl phthalate, b₂₀ 206°, is made from phthalic anhydride and BuOH by heating, addn. of dry HCl and further heating and treatment for purification. Phthalic acid also may be used as starting material. Monobutyl phthalate, m. 73-4°, sol. in the usual org. solvents and in alkali, is obtained as a by-product. Ethyl butyl phthalate, b₂₀ 183°. Butyl benzyl phthalate is a heavy oily compd. These esters may be used as solvents for terpenes, esters, aldehydes, etc., such as are used in perfumery.

Isobornyl esters. J. EBERT. U. S. 1,555,947, Oct. 6. A mixt. of pinene hydrochloride and dipentene hydrochlorides such as those obtained by treating pinene with HCl is heated to a temp. of about 80-119° together with a fatty acid and a "metamerizing" metal, e. g., Sn or Zn and a small proportion of Cu or Fe.

Formaldehyde-sulfoxylate compounds of 4-amino-2-argento-mercaptobenzene-1-carboxylic acid. CHEM. FABRIK AUF AKTIEN FORM. E. SCHERING. Brit. 231,699, May 30, 1924. The acid or its alkali salts are treated with Na formaldehyde-sulfoxylate; or 4-amino-2-mercaptobenzene-1-carboxylic acid is treated with Na formaldehyde-sulfoxylate and a Ag salt then added. Details of both methods are given.

Nitro-5-chloro-2-hydroxytoluene. A. G. BATES, F. S. BRIGHTMORE and W. H. WEBBER. Brit. 230,968, Feb. 16, 1924. 5-Chloro-2-hydroxytoluene is sulfonated with cold concd. H₂SO₄ and the sulfonation mixt. run into an aq. soln. of NaNO₃. The product may be used for preserving wood.

4-Hydroxynaphthalene-1-arylketones. G. DE MONTMOLLIN, E. REBER, G. BONHOTE and J. SPIELER. U. S. 1,552,472, Sept. 8. These compds. are whitish powders dissolving in NaOH soln. with a yellow coloration. They may be obtained by heating 1-phenylketone-4-hydroxynaphthalene-3-sulfonic acid or similar compds. with 5% H₂SO₄ soln. or other diluents.

Aryloxynaphthylketones. G. BONHOTE, G. DE MONTMOLLIN and SOC. ANON. POUR L'IND. CHIM. A BALE. Brit. 231,342, May 7, 1924. Aryloxynaphthylketones are produced by interaction of at least 1 mol. proportion of an arylchloroform such as phenylchloroform and 1 mol. proportion of a naphthol or of a naphthol-sulfonic or -carboxylic acid.

Stabilized styrene. I. OSTROMISLENSKY and M. G. SHEPARD. U. S. 1,550,323, Aug. 18. To prevent polymerization of styrene, it is admixed with about 1/4-1% of trinitrobenzene or a similar org. substance. U. S. 1,550,324 specifies stabilizing styrene with quinone.

• **Homologs of styrene from aromatic hydrocarbons.** I. OSTROMISLENSKY and M. G. SHEPARD. U. S. 1,552,874, Sept. 8. Compds. of the general formula $R'ArCH:CH_2$ in which Ar represents arylene and R' represents a substituent such as alkyl, aryl or an element are made by heating *o*- or *p*-ethyltoluene or other hydrocarbon having the general formula $R'ArC_2H_4R$, where R represents H or a substituent, to 450–700° and partially decomposing the $-C_2H_4R$ of the compd. to convert it to $-CH:CH_2$. U. S. 1,552,875 also relates to the production of *p*-methylstyrene or other homologs of styrene from aromatic hydrocarbons such as *p*-methylisopropylbenzene by a somewhat similar process.

3-Nitrophthalic acid. E. R. LITTMANN. U. S. 1,549,885, Aug. 18. Phthalic anhydride is caused to react with about 3 mol. proportions each of HNO_3 and H_2SO_4 and the reaction product is poured into H_2O .

Arylthioglycolic acids. A. W. JOYCE. U. S. 1,550,075, Aug. 18. An *o*-diazarylthioglycolic acid is treated with EtOH or other aliphatic alc. and a reducing agent, *e. g.*, Fe and H_2SO_4 , 5-chloro-3-methylphenylthioglycolic acid is formed, from 5-chloro-3-methyl-2-diazophenylthioglycolic acid.

Chlorosulfonic acid. R. H. MCKEE and C. M. SALLS. U. S. 1,554,870, Sept. 22. Sulfuryl chloride and H_2SO_4 are heated together in the presence of a Hg compd. such as $HgSO_4$ or $HgCl_2$ or of salts of Sb, Sn or Bi.

Alkali metal compounds of arsenophenols. A. E. SHERNDAL. U. S. 1,550,109, Aug. 18. In prep. the Na compd. of diaminodihydroxyarsenobenzene or other stable alkali metal compds. of arsenophenols and their substitution derivs., the arsenophenols are combined with alkali metals in strong alc. contg. NaOH or other medium in which the resulting alkali metal compds. are insol. Mannitol, glucose or Na formaldehyde-sulfoxylate may be added as stabilizers.

Derivatives of 4-hydroxypiperidine. H. STAUDINGER. Brit. 232,207, April 8, 1924. A diallylcarbinol ester or a substitution product is converted into its hydrochloride and the latter condensed with NH_3 or with a primary aliphatic, aromatic, or aliphatic-aromatic amine to effect the piperidine ring closure. The prepn. of benzoic esters of 2,6-dimethyl-*N*-methyl- or phenylethyl-4-hydroxypiperidine; 2,6-dimethyl-*N*-methyl-4-hydroxypiperidine and similar compds. is described.

Esters of 4-hydroxypiperidine. H. STAUDINGER. Brit. 232,206, April 8, 1924. Anesthetic substances are prepd. by esterifying an *N*-aralkyl-4-hydroxypiperidine or a C-substitution deriv. having the substituent in the piperidine ring. Manuf. of the benzoic and mandelic acid esters of 2,6-dimethyl-*N*-phenylethyl-4-hydroxypiperidine are described.

Chloroperylenes. H. PEREIRA. Brit. 232,261, April 10, 1924. A soln. or suspension of perylene is treated with a current of Cl or with other chlorination agents such as sulfuryl chloride in the presence of a small quantity of I. Examples and details are given.

Perylene quinones. H. PEREIRA. Brit. 232,264, April 10, 1924. Halogen derivs. of perylene, *e. g.*, perylene dibromide, are heated with concd. H_2SO_4 and the product is pptd. with H_2O .

Isopropyl aromatic amines. H. E. BUC. U. S. 1,555,451, Sept. 29. Monoisopropyl aromatic amines are formed by heating primary aromatic amines such as $PhNH_2$, *o*- or *p*-toluidine, with isopropyl chloride. The oily liquid products may be used in making dyes or for stabilizing explosives.

Isopropyl-*p*-aminophenol. H. E. BUC. U. S. 1,555,452, Sept. 29. Isopropyl-*p*-aminophenol, a white cryst. solid, m. 148–152°, is made by heating together isopropyl chloride and *p*-aminophenyl. It may be used for dyeing furs or in photographic developers.

Phenylrosinduline. A. WAHL and R. LANTZ. U. S. 1,555,535, Sept. 29. 4-Phenylamino-1-phenylamino- β -naphthoquinone or one of its metal compds. is heated in aniline. Benzoic acid or $ZnCl_2$ may be used as a catalyst.

Recovering oxalates, etc., from vegetable materials. W. A. FRAYMOUTH and BHOPAL PRODUCE TRUST, LTD. Brit. 231,211, Oct. 25, 1923. Ca oxalate and other org. compds. are recovered from the bark of *Terminalia arjuna* or the flesh of plants of the genus *Opuntia* by passing an aq. pulp of the material over a rubber, woolen, rough wood or other surface to which the desired products adhere. Cf. C. A. 19, 1143.

11—BIOLOGICAL CHEMISTRY

PAUL E. HOWE

A—GENERAL

FRANK P. UNDERHILL

The question of sensitizing Congo red by means of globulin. G. ETTISCH AND H. RUNGE. *Kolloid-Z.* 37, 26-31(1925).—Brossa (cf. *C. A.* 17, 1487) reports that Congo red is sensitized by globulin. Becker (cf. *Z. Immunitäts.* 41, 378) reports that no such sensitizing takes place. Some of the authors' expts. indicated that a smaller amount of NaCl would coagulate Congo red in the presence of globulin; other expts. did not. Then some other significant component must be present. First the Congo red was dialyzed. Its color became a brighter red. Its p_H value changed from 6.98 to 4.16 after 72 hrs. dialysis. Neither cond. nor p_H value of globulin kept at 5° changed within 3 days. Congo red becomes Congo blue and ppts. at about p_H 4. In a soln. 0.001 *N* with HCl both Congo red and globulin remain in soln. Above p_H 7 the globulin is peptized. There is a pptn. zone between p_H 4 and p_H 7. The presence of Congo red has no effect on the pptn. of globulin, and globulin has no effect on the pptn. of Congo red. Congo red ppt. will adsorb globulin completely from soln. Congo red sols and Congo red-globulin sols were treated with BaCl₂ and La(NO₃)₃. They were equally subject to flocculation and the La(NO₃)₃ was effective in a concn. of 1 millimol per l., while BaCl₂ required 40 millimols per l. *Lecithin* (cf. Beck, *C. A.* 19, 3190) has no more effect on the coagulation of Congo red than globulin has.

F. E. BROWN

Experimental researches on the catalytic action of certain colloids, and especially of glycogen, compared with enzymic phenomena. L. HUGOUNENQ AND J. LOISELEUR. *Bull. soc. chim. biol.* 6, 791-811(1924).—Certain colloids appear to exert through their phys. state alone favorable action on the rapidity of protein hydrolysis. Glycogen possesses this power feebly; it is manifested only in the presence of electrolytes, of which minute traces are sufficient. Such action may be of importance in intracellular reactions. Ultra-radiations seem to produce, by themselves, no effect on protein disintegration.

A. T. CAMERON

Hydrogen-ion concentration and the oxidation-reduction potential of the cell-interior: a microinjection study. JOSEPH NEEDHAM AND DOROTHY M. NEEDHAM. *Proc. Roy. Soc. (London)* 98B, 259-86(1925).—In the abstract in *C. A.* 19, 2332 the word "microchemical" should read "microinjection."

E. J. C.

Transformation products of the pigments from flesh and blood. IV. Formation of porphyrins from flesh. O. SCHUMM. *Z. physiol. Chem.* 147, 184-220(1925); cf. *C. A.* 19, 1714, 2675.—From com. beef and beef hearts a CHCl₃-sol. porphyrin was obtained in small quantity by extn. with AcOH-Et₂O and treatment of the ext. with HCl. Its properties correspond to those of the CHCl₃-sol. α -porphyrinoid, as also to Papendieck's, and Kämmerer's porphyrins. Coproporphyrin or a similar porphyrin was not found. The same treatment of flesh and hearts which had undergone putrefaction for several weeks at 15° yielded the porphyrin in distinctly increased amt. A 2nd porphyrin was observed in only 1 instance where the meat had putrefied 3 year. This showed certain similarities to coproporphyrin as also to some other porphyrins, but its identity was not established. After spontaneous putrefaction at 37° very considerable quantities of porphyrin were obtained by the same procedure. In some expts. only the CHCl₃-sol. porphyrin was found, in others a 2nd porphyrin resembling coproporphyrin, mesoporphyrin and hematoporphyrin, but it could not be identified. Decompn. of putrid meat by fuming HCl gave a mixt. of various porphyrins. Besides the ordinary CHCl₃-sol. porphyrin a 2nd porphyrin was obtained as before. In some expts. a porphyrin was obtained which differed from Nencki's hematoporphyrin in its CHCl₃ soly., and from the ordinary CHCl₃-sol. porphyrin in its spectrum, this being more similar to that of mesoporphyrin but distinctly different in alk. soln. The data do not preclude the possibility that a part of the coproporphyrin of physiol. origin arises from muscular tissue, but afford no proof that a pigment is present in muscle which contains as a prosthetic group coprohemin, the hypothetical natural parent substance of coproporphyrin. Satisfactory identification of the small quantities of coproporphyrin obtained in putrefaction expts. is rendered difficult by the fact that the blood pigment yields a porphyrin which is very similar and shows absorption bands in close proximity to those of coproporphyrin. V. The hemochromogens and hematin formed in the putrefaction of flesh and blood, and their related porphyrins. *Ibid* 221-47.—From meat, organs and blood, which had been allowed to putrefy under varying conditions,

•pigment solns were obtained which gave the spectrum of the true hemochromogen from α -hematin as well as the spectra of 4 or 5 more or less similar derivs. In many instances, mixed spectra were observed which indicated the presence of mixts. of the Fe derivs. of various porphyrins. In the putrefaction of meat or blood the following hematins may occur—(1) α -hematin; (2) a hematin which behaves essentially like the Fe complex of Nencki's hematoporphyrin; (3) a hematin which corresponds spectroscopically to the Fe complex of mesoporphyrin or coproporphyrin; (4) a hitherto unknown hematin-like pigment which after removal of the Fe gives a spectrum corresponding to that of hemoporphyrin or etioporphyrin. Apparently, the blood pigment on putrefaction yields first hemochromogen, the hematin of which shows the same general behavior as α -hematin. It is sol in dil KOH, AcOH, Et₂O or CHCl₃ contg. AcOH, and in pyridine. When treated with (NH₄)₂H₂O it gives a porphyrin in all probability identical with α -porphyrindin or α -hematoporphyrin. Long-continued putrefaction of meat and organs at 37° yields as a secondary transformation product a hematin-like pigment which no longer shows the characteristic reactions of α -hematin. This, however, may not be a homogeneous substance. The product obtained by treatment with (NH₄)₂H₂O, pyridine and removal of Fe showed marked similarity to Nencki's hematoporphyrin and also to mesoporphyrin or coproporphyrin. Putrefaction of beef or beef hearts at 15° gave mainly a hematin with the properties of α -hematin, but it is probable that small quantities of 1 of the other hematins were also present. A secondary putrefaction product differing markedly from α -hematin was obtained by long-continued putrefaction of human blood at 37°. It is probably identical with the pigment recently obtained from feces. Its spectrum is distinct from that of hemochromogen, and the 2 substances may be identified spectroscopically in the same soln. Removal of Fe from the new pigment gives an unidentified porphyrin with absorption bands displaced toward the violet.

A. W. Dox

Invertase: X. RICHARD WILLSTATTER, KARL SCHNEIDER AND EUGEN BAMANN. *Z. physiol. Chem.* **147**, 248-74 (1925); cf. *C. A.* **19**, 3095.—By a simple process of fractional autolysis of yeast, invertase preps. have been obtained with a sucrase content equal to those previously prepd. by the long process of aging, pptn. with EtOH and adsorption on kaolin, and at the same time exhibiting greater stability. In these preps the content of other enzymes is less but that of accompanying substances is greater. Repeated application of alumina and kaolin adsorption under the usual conditions does not, as a rule, increase the purity of such preps, but by certain modifications of the adsorption method the sucrase value has been increased 28% over that of the best preps hitherto obtained. One such prep still contained 8.6% of tryptophan as a peptide complex, and the actual enzyme present was probably not over 50%. The new procedure is based on the fact that when undild yeast is killed by PhMe and liquefied at 30°, instead of room temp., the juice is comparatively low in invertase, and rich in gum and other foreign substances. The purity of the autolysate can therefore be increased by sepg the yeast from the preliminary autolysate and then collecting a second autolysate obtained by a further treatment with H₂O and PhMe. The 1st liquefaction requires about 45 min. and the subsequent autolysis 6-24 hrs. The no. of sucrase units in this autolysate are about 10 times as great as those in the crude autolysates by the older method. Dialysis of the autolysate decreases the amt of tryptophan and tyrosine complexes, but increases the % of yeast gum, and at the same time increases the sucrase activity. Adsorption on kaolin then removes the gum and lowers the tryptophan content still further, but this purification is attended by a loss of enzyme due to decreased stability from the removal of protective substances.

A. W. Dox

Enzymic cleavage of glucosides. The mode of action of the β -glucosidase of emulsin. KARL JOSEPHSON. *Z. physiol. Chem.* **147**, 1-154 (1925).—The enzyme prep. was made by extn. of the fat-free almond powder with dil. NH₄OH, pptn. of the proteins with AcOH, pptn. of the enzyme with EtOH or MeAc and dissolving the ppt. in H₂O. The kinetics of the reaction was studied in the cleavage of salicin, helicin, β -methylglucoside, and arbutin. The 1st 2 glucosides underwent cleavage with a velocity, which showed quite const. values for the reaction coeffs. as calcd. by the formula for monomol reactions. In the cleavage of arbutin a decrease in velocity was observed as the reaction progressed, and the calcd. reaction coeffs. of the 1st order showed decreasing values. This deviation in kinetics from that of the salicin and helicin cleavage was traced to an inhibition by hydroquinol. The kinetics is dependent on the acidity of the reaction medium. A partial explanation of this is to be found in the difference in stability of the enzyme at different acidities. The varying mutarotation velocity of the liberated β -glucose should also be taken into consideration. For the characterization of the enzymic activity of β -glucosidase preps the term *Sal. f* is introduced, which

denotes the capacity for salicin cleavage, this being the reaction coeff. k divided by the amt. of enzyme prepn. (dry wt.) used in the detn. of k in 50 cc. of the reaction mixt. The affinity- p_H curves of enzymic cleavage were found to be in close agreement for salicin and helicin, thus contradicting the earlier statements of Willstätter and Oppenheimer. The curve for β -methylglucoside is displaced somewhat to the acid side, and the curve for arbutin is still further displaced. The p_H optima are: β -methylglucoside, salicin and helicin cleavage 4.4, arbutin cleavage 4.1. The apparent dissoc. or affinity const. of the enzyme-substrate compds. for the 4 glucosides are: β -methylglucoside 1.4, salicin 33, helicin 62, arbutin 24. The influence of acidity on the apparent affinity const. of the salicin-enzyme compd. is similar to that previously observed with glucose-sucrase. Calcn. of the activity p_H curve of salicin, helicin and β -methylglucoside cleavage could be performed in a manner similar to that of sucrase and raffinase, assuming the electrochem. nature of the β -glucosidase and β -glucosidase-substrate compds., when the change in affinity const. of the enzyme-substrate compds. with the acidity was taken into consideration. On comparing acid and enzyme hydrolysis of arbutin and salicin large differences were observed, similar to those found by Kuhn and Sobotka in the case of β -phenylglucoside and salicin. Both forms of glucose inhibit β -glucosidase action, the inhibition being somewhat more pronounced with β - than with α -glucose. Calcd. values of the affinity const. of the glucose-enzyme compds. agree well in sep. expts. with various substrates. This is considered noteworthy on account of the great difference in affinity const. of the enzyme-glucoside compds. The inhibition of β -glucosidase action by the 2 forms of xylose (freshly dissolved and equil. form) showed a difference similar to that previously found in the case of sucrase. The freshly dissolved form exerted a greater inhibition than the equil. form. This fact, as well as the observed alteration of affinity const. of the salicin- β -glucosidase compd. and glucose-sucrase compd. with change of acidity, points to a noteworthy similarity between the "glucose affinities" of the 2 enzymes. Galactose and arabinose inhibit β -glucosidase action but not as strongly as glucose or freshly dissolved xylose. The inhibition appears to be due mainly to the β -forms, and this again coincides with the observations on sucrase. Fructose and disaccharides do not inhibit β -glucosidase. Considering the similarity of glucose affinities of sucrase and β -glucosidase and the action of fructose on sucrase, the inactivity of fructose with respect to β -glucosidase action makes probable the existence of sep. glucose and fructose affinities of sucrase. In the inhibition of β -glucosidase by alcohols 2 different inhibition phenomena appear to occur simultaneously. (a) an inhibition which is dependent on the concn. of the substrate and thus indicative of an affinity between enzyme and alc., and (b) an inhibition due to the decrease in decompn. velocity of the enzyme-substrate compd. From the residual inhibition of the 1st type the apparent affinity const. of the alcohol-enzyme compds. present according to the theory may be calcd. These const. show no progression on changing the substrate concn. and are independent of the affinity const. of enzyme-substrate compd. in the sense that the values calcd. from the inhibitions of the cleavage of various substrates are in agreement. The const. were calcd. for MeOH , saligenin, salicylaldehyde, PhOH , $p\text{-C}_6\text{H}_4(\text{OH})_2$ and $p\text{-MeOC}_6\text{H}_4\text{OH}$. The inhibition of salicin and arbutin cleavage by hydroquinone is reconcilable with the assumption that salicin and arbutin are hydrolyzed by one and the same enzyme. The affinity of the β -glucosidase preps. for different hydrolyzable glucosides may be considered a composite of 2 partial affinities for the 2 components of the substrates. Quant. calcs. of relative specificity (affinity) make it possible to predict the approx. affinities toward various substrates from the partial affinities.

A. W. Dox

Enzymic synthesis of glucosides. The synthesizing action of the β -glucosidase of emulsin. KARL JOSEPHSON. *Z. physiol. Chem.* 147, 155-83(1925).—In the enzymic synthesis of β methylglucoside by emulsin the velocity is proportional to the amt. of enzyme. The activity p_H curve nearly coincides with the corresponding curve for cleavage. For the calcn. of H-ion concn. in $\text{MeOH-H}_2\text{O}$ mixts. the gas-chain method is applicable up to 40 vol. % of MeOH . The influence of glucose concn. on the velocity of synthesis of β -methyl- and β -ethylglucoside was studied and the affinity const. of the glucose-enzyme compd. calcd., the validity of the law of mass action being assumed. This const. was independent of the concn. (30-40%) and the nature (Me or Et) of the alcohol. Its magnitude was nearly equal to the value ascertained by inhibition expts. in various glucoside cleavages. The inhibition of synthesis by MeOH appears to be of the same order of magnitude as the inhibition of the 2nd type (cf. preceding abstr.) by MeOH in the salicin cleavage. Attempts to synthesize β -phenylglucoside showed that only slight synthesis occurs and that the equil. is close to that of complete cleavage of the glucoside.

A. W. Dox

of animal proteases. II. The tryptic and ereptic action of the pan-
creatic enzyme. A. W. DOX. *Z. physiol. Chem.* 147.

liquor contained the trypsin and the intestinal liquor contained the erepsin. The other enzyme. Trypsin was detd. by allowing the soln. to act on 8% gelatin soln. at pH 7.8 and titrating the liberated amino acids in the presence of alc. Erepsin was detd. in the same manner by titrating the amino acids liberated from leucylglycine, toward which trypsin is inactive. A comparison of pancreatic with intestinal erepsin showed that the 2 are apparently identical.

A. W. DOX

Investigations on oxidases. I. The formation of indophenol blue crystals in the presence of different colloids. II. The oxidase reaction in surviving preparations. III. Oxidase reaction of spermatozoa. E. SERENI. *Arch. fisiol.* 22, 179-83, 185-9, 191-5 (1924); *Physiol. Abstracts* 10, 81-2.—I. The conclusions reached by Reed as regards the influence of solns. of gelatin, gum and egg albumin on the formation of crystals of indophenol blue could only in part be confirmed, while blood serum was found to be completely ineffective. II. The oxidase reaction is considerably reduced in surviving preps. of the central nervous system or heart of toads. III. The Gierke oxidase reaction is positive in the spermatozoa of man and guinea pigs when fully formed.

H. G.

An interpretation of the biological reduction of methylene blue. W. M. CLARK, BARNETT COHEN AND H. D. GIBBS. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, liv-lv (1925); cf. *C. A.* 19, 2770.—“Electrode potential measurements with cell suspensions (bacteria and liver) give data agreeing with those calcd. from the data for the reduction of methylene blue. The potentials thus established by 2 methods lie in a zone where there can be no appreciable quantity of either H_2 or O_2 in equil. with the system. If either gas be present it can be considered only in relation to a dynamic process and not to a static equil.”

I. GREENWALD

Chemical change in fish muscle during rigor mortis. C. C. BENSON. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, lxxii-lxxiii (1925).—“Before rigor set in, the amt. of sol. myogen fibrin was less than during rigidity. . . The amt. decreased as the stiffness passed off.”

I. GREENWALD

On specific sperm agglutinins. G. H. A. CLOWES AND EDA B. WALDEN. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, lxiiv (1925).—“The substance derived from sea urchin eggs by H_2O extn., which is capable of exerting a specific agglutinating action on sea urchin sperm, may be profoundly modified as regards its susceptibility to heat and various chem. reagents by extg. certain lipoids from the soln. contg. the agglutinin or by treating the eggs in advance with certain org. reagents. These results harmonize with those previously observed by the writer regarding the influence exerted by lipoids on the heat-sensitivity of pollen toxins, and appear to throw some light on the physical constitution of protoplasmic particles.”

I. GREENWALD

Movement of electrically charged atoms inside red blood corpuscles. J. F. MCCLINTON. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xiv (1925).—“Preliminary expts. indicate that the cond. of the ox erythrocyte interior is about equal to or greater than that of a 0.01 *N* KCl soln.” The Wheatstone bridge method, with a current of 1,000,000 cycles per sec., was used.

I. GREENWALD

Supersaturated solutions of uric acid. RUDOLF STERN. *Klin. Wochschr.* 3, 1583 (1924).—By dissolving in hot H_2O and cooling, a supersatd. soln. of Na urate can be prepd. that is stable for several days. The soln. is colloidal. Uric acid is twice as sol. in a 1% soln. of Na salicylate and 3 times as sol. in a 1% soln. of the Na salt of cinchophen as it is in H_2O .

MILTON HANKE

The presence of the feminine sexual lipid in bird eggs and in the ovaries of fish. O. O. FELLNER. *Klin. Wochschr.* 4, 1651-2 (1925).—Egg yolks and fish ovaries were subjected to a chem. process identical with that used for the prepn. of the active mammalian ovarian lipid. The product so obtained was then injected, in the course of 8 days, into a 1 kg. rabbit, that had previously been deprived (operation) of 1 horn of its uterus. The animal was killed on the eighth day. The remaining horn of the uterus had enlarged to 11 times its original size under the influence of a lipid ext. from 30 eggs. An identical enlargement was obtained with the lipid ext. from 125 g. of fish ovaries. The lipid from 2 placenta produced a 16-fold enlargement in 8 days. The mammac were typically enlarged in every case. Histology is also given. The lipid from 30 eggs is, therefore, equiv. in activity to more than 1 placenta or 90 corpus luteums. Some interesting deductions are made as follows. One egg contains as much active substance

as 100 of the ordinary ovarian tablets and almost as much as 1 intravenous dose of ovarian lipid. Eggs must have a tendency to augment the bleeding of puberty and menstruation and should be avoided at this time. The amenorrhea of war may have been partially due to a lack of egg in the diet. Since ovarian ext. produces a hypertrophy of the mammae but inhibits milk secretion, eggs should be advantageous during pregnancy and contraindicated during lactation. It is also interesting in this connection that both eggs and caviar have long been classed as aphrodisiacs by the general public.

MILTON HANKE

Studies on xanthine oxidase. VI. A cell oxidase system independent of iron. MALCOLM DIXON AND SYLVA THURLOW. *Biochem. J.* 19, 672-5(1925); cf. *C. A.* 19, 3097.—Warburg (*C. A.* 18, 3198) claims that O_2 must always be activated by Fe before it can oxidize org. substances. However, neither cyanide nor pyrophosphate (which inhibits Fe catalysis) inhibits the oxidation of hypoxanthine in the presence of xanthine oxidase. Neither does the addn. of Fe to the system produce any acceleration of oxidation.

BENJAMIN HARROW

Cholesterol and its esters. II. E. KEESER. *Biochem. Z.* 157, 166-71(1925); cf. *C. A.* 19, 1868.—The pptg. action of K and Na salts of cholesterol-sulfuric acid upon As_2S_3 sols depends upon the soly. of the salt. The addn. of urea or glycocholl to an As_2S_3 or S sol increases its stability. Increasing concns. of Me, Et, Pr, iso-Pr, and Bu alcs. increase in reverse order the cond. of sols of cholesterol and its esters. Alcs. therefore peptize cholesterol and its esters.

W. D. LANGLEY

Cell respiration. II. The mechanism of oxidation of lactic acid. A. v. SZENT-GYÖRGYI. *Biochem. Z.* 157, 50-66(1925); cf. *C. A.* 19, 1869, 2213.—To prove whether or not the oxidation of lactic acid in tissues is dependent upon the presence of a coenzyme, the diaphragm muscle of rats and swine was minced and extd. with cold H_2O . Detns. of O consumed and CO_2 evolved were made. The extd. muscle was not able to oxidize lactic acid, but did dehydrogenate it, although it could not oxidize the H. Succinic acid and *p*-phenylenediamine were both oxidized by the extd. muscle. If the ext. were placed with the muscle again, lactic acid was then oxidized with consumption of O . The ext. alone was not an activator in this sense. Therefore a coenzyme of a relatively simple nature is present in muscle and aids in the oxidation of lactic acid. **III. Re-activation with artificial coenzymes.** *Ibid* 67-84.—Catalase, methylene blue and glutathione do not act as the coenzyme in the oxidation of lactic acid. Glutathione is prevented by the CN ion from acting as an autoxidizer, whereas small concns. of metal ions accelerate this action. Active oxygen of the tissues fails to oxidize glutathione. Certain phenols and *p*-phenylenediamine do bring about autoxidation in muscle. The oxidation of a substance depends upon its adsorbability. Quinonediimine is very slowly reduced by washed muscle, but in the presence of lactic or succinic acids, it is quickly reduced.

W. D. LANGLEY

Occurrence of tryptophan in silk fibroin. E. HIRATSUKA. *Biochem. Z.* 157, 46-9(1925).—Silk fibroin is hydrolyzed with $Ba(OH)_2$, and tryptophan isolated from the resulting soln. The picrate, benzenesulfo and β -naphthalenesulfo derivs. are prepd.

W. D. LANGLEY

Auxo-influence of protein-free colloids upon hydrolysis of urea by soy urease. GERT TAUBMANN. *Biochem. Z.* 157, 98-102(1925).—Gum arabic and starch augment the hydrolysis of urea by soy-bean urease, but alone have no influence. Simple carbohydrates such as glucose do not affect the hydrolysis.

W. D. LANGLEY

The bound water in colloids and animal tissues. F. THOENES. *Biochem. Z.* 157, 174-86(1925).—From the heat of solidification at -20° of various colloids in H_2O , and from the amt. of H_2O known to be present, the bound H_2O , which does not freeze, may be calcd. Reproducible results are easily obtained on non-living colloids and tissues. In the case of tissues, the bound H_2O represents the "intensity of binding" of the H_2O by the living tissue. Young animals have more bound H_2O than old. The change with age is due to the change in physical structure of the tissue.

W. D. L.

Tryptic digestion at low enzyme concentration. II. R. EHRENBERG. *Biochem. Z.* 153, 362-71(1924); cf. *C. A.* 19, 2273.—There is probably a hydrolytic enzyme obtained from casein itself as it is hydrolyzed by trypsin. It is certain that the enzyme is changed in some way other than by being bound. The slowing of the enzyme action due to the hydrolytic products formed is a reversible process.

W. D. LANGLEY

The effect of low blood pressure and ether anesthesia on blood alkali. B. R. LUTZ AND L. C. WYMAN. *Am. J. Physiol.* 73, 264-73(1925).—Low blood pressure, obtained in cats by destroying the brain, was accompanied by low alk. reserve in the blood shortly after the operation, which increased and remained relatively high until a final decrease

occurred as the cat became moribund. When ether was administered after brain destruction the blood alk. reserve remained low as long as the ether was given. The physiol. and pathol. bearing of the expts. is discussed. J. F. LYMAN

A cyanosis, unrelated to oxygen unsaturation, produced by increased peripheral venous pressure. S. GOLDSCHMIDT AND A. B. LIGHT. *Am. J. Physiol.* **73**, 173-92 (1925).—When the arm is allowed to hang down and kept stationary the resulting blue color of the hand results from the engorgement of the capillaries and venules rather than from an increased unsatn. of the blood in these vessels. Circulation rate in the hand under these conditions may be unchanged. J. F. LYMAN

Length of muscle, and the heat and tension developed in an isometric contraction. A. V. HILL. *J. Physiol.* **60**, 237-63 (1925).—Heat production of muscular contraction is max. when the muscle length is about 90% of the resting unloaded length, and tension is max. when the relative length is about 98%. Both tension and heat production decrease considerably on either side of these maxima positions. The mechanisms of muscular contraction are discussed. J. F. LYMAN

The composition of alveolar air at extreme heights. T. H. BOMERVELL. *J. Physiol.* **60**, 282-5 (1925).—At an altitude of 23,000 ft. during the Everest expedition of 1924, alveolar CO_2 was very low. The alveolar respiratory quotient was extremely low, 0.33 to 0.44, and the sum of alveolar CO_2 and alveolar O_2 was low (15.3 to 17.7% instead of the expected nearly 20%). J. F. LYMAN

An analysis of the heat production during a contraction in which work is performed. W. HARTREE. *J. Physiol.* **60**, 269-75 (1925).—When a muscle shortens, doing work, the energy liberated as heat is const. provided the weight lifted is held up so it does not bear on the muscle during relaxation. In such a contraction the muscle supplied extra energy equal to the work done. An analysis of the heat production shows that, apart from the liberation of this extra energy as work, there is a considerable increase in the heat produced during the earlier phases of contraction, compensated by a deficit during relaxation. J. F. LYMAN

The passage of water through the skin of the frog, and the relation between diffusion and permeability. E. F. ADOLPH. *Am. J. Physiol.* **73**, 85-105 (1925).—Permeability to H_2O is not different from the conditions for H_2O diffusion. Permeability only depends in small part upon the particular structure of a phase boundary, it depends, at least up to the limits of its variability, upon elec. conditions. Expts. on frog skin and on collodion membranes are described. J. F. LYMAN

A comparison of the gaseous content of blood from veins of the forearm, and the dorsal surface of the hand as indicative of blood flow and metabolic differences in these parts. S. GOLDSCHMIDT AND A. B. LIGHT. *Am. J. Physiol.* **73**, 127-45 (1925). O_2 and CO_2 in blood from veins on the back of the hand and from veins in the forearm differ. The possible causes for these differences are discussed. J. F. LYMAN

The effect of local temperature upon the peripheral circulation and metabolism of tissues as revealed by the gaseous content of venous blood. S. GOLDSCHMIDT AND A. B. LIGHT. *Am. J. Physiol.* **73**, 146-72 (1925).—When the arm is immersed in water below 18° there is evidence of (1) a decreased metabolic rate in the cooled tissues, (2) a decreased dissociation rate of oxyhemoglobin, (3) a combination of effects 1 and 2, and (4) a decreased rate of circulation of the blood in the cooled member. The effects of other temps. are described and the physiol. application of the expts. is discussed. J. F. LYMAN

The combination of carbon dioxide in the blood of the bull frog (*Rana catesbeiana*). H. WASTL AND A. SELISKAR. *J. Physiol.* **60**, 261-8 (1925).—The blood of the bull frog at 15° binds a comparatively high amt. of CO_2 but is less well buffered than the blood of mammals, though it may be slightly more alk. J. F. LYMAN

The lytic effect of saponins on the formed elements of the blood in vitro. ALLAN BESKOW. *Skand. Arch. Physiol.* **46**, 279-90 (1925).—The *in vitro* hemolysis produced by saponin gives no clue to the *in vivo* process of red-cell destruction. Saponin causes the *in vitro* soln. of blood platelets but the loss of platelets *in vivo* is not occasioned by the same agency as in the test tube process. S. MORGULIS

The role of potassium and sodium ions in an isosmotic perfusion solution of glucose. P. BENGOUX. *Compt. rend. soc. biol.* **43**, 58-60 (1925).—In an isosmotic perfusion liquid of glucose buffered to a pH 7.8 the min. of Na (9.8 cc. of 0.1 N NaOH per l.) cannot be replaced with the other ions (K or Ca) present in Ringer soln. In these min. doses the Na cannot be together with K or Ca. When the Na content is raised (re adjusting the glucose content to maintain isosmotic relations) the height of the heart contraction increases up to an optimum of 250 mg. per l., then diminishes, becoming

very feeble with a Na content of 700–800 mg., though the contractions persist even when the Na value reaches 2.5–2.75 g. per l. In order to maintain the height of contraction • at its optimum it becomes, however, necessary to add a mixt. of K and Ca, the amts. necessary being proportional to the increase in the Na content of the perfusion soln.

S. MORGULIS

Presence of argon in living cells. AMÉ PICTET, WERNER SCHERRER and LOUIS HELFER. *Compt. rend.* **181**, 236–8(1925); cf. *C. A.* **19**, 2687.—Com. yeast was dried in a vacuum at 25° and over H₂SO₄. Portions of the dried product were analyzed by standard methods and found to yield from 0.28 to 0.30 cc. of A per g. of dry yeast. The identity of the A was confirmed by its spectrum. The clot of beef blood which had been sepd. by the centrifuge, and sheep brain were dried and analyzed, giving 0.84 and 0.86 cc., resp., of A per g. of dried material. The exact state of the A in the cells is uncertain but it does not appear to be retained by adsorption. Neither fibrin nor hemoglobin yielded any inert gas under similar treatment.

L. W. RIGGS

Protoplasmic action of copper and gold. C. VORGTLIN, J. M. JOHNSON and H. A. DYER. *Proc. Nat. Acad. Sci.* **11**, 344–5(1925).—The toxic effect of Au and Cu salts on plant and animal protoplasm is one of chem. action. This contention is not precluded by the fact that these salts exert a toxic effect even in very low concns., from expts. described by the authors. The toxic action of higher concns. of heavy metal salts may be due to a coagulating action on cellular proteins, but in high dilns. of these salts this can scarcely be the case. It is believed that the cellular glutathione oxidation-reduction mechanism is disturbed in the presence of these salts and that death might be conceived as a special type of asphyxia.

W. F. GOEBEL

• **Effect of light on the permeability of lecithin.** S. C. BROOKS. *Science* **61**, 214–5 (1925).—Becking and Gregersen (cf. *C. A.* **19**, 3273) claimed that permeability of membranes consisting of lecithin and collodion in equal proportions was increased by illumination. Brooks shows that such a change in permeability is in need of further exptl. support.

L. W. RIGGS

Ultra-violet light and the oxidation of cod-liver oil. FARRINGTON DANIELS and R. J. FOSBINDER. *Science* **62**, 266(1925).—Further tests failed to confirm the statement of Kugelmass and McQuarrie, *C. A.* **19**, 353, 2964, that ultra-violet light is emitted when cod-liver oil is heated.

L. W. RIGGS

High energy chemistry and vitamins. R. C. C. BALY. *J. State Med.* **33**, 367–76 (1925).—This interesting address closes with the following: "On the one side we find the old chemistry of the lab., the chemistry of low energy; on the other side we find the chemistry of life, that wondrous chemistry of high energy. When death supervenes, the essential principle of the living organism, the high energy content, is slowly radiated away, and we find by our methods of analysis nought but the dull compds. themselves with all the magic of their vital functions lost. Let us realize that the chemistry of the test tube, flask and beaker, the org. chemistry of today, can teach us now no more of life by reason of the low energy restrictions set upon it. I ask you to visualize a new chemistry, a glimpse of which I believe has now been caught, the chemistry of high energy. There at length perhaps we may aspire to that greatest science of all, the chemistry of man in health and disease."

L. W. RIGGS

Separation of the depressor principle from hepatic tissue. A. A. JAMES, N. B. LAUGHTON and A. BRUCE MACALLUM. *Science* **62**, 181(1925).—The active principle is non-protein in character and is found in the abiuret fraction. It is pptd. from aq. solns. by phosphotungstic acid along with the diamino acid fraction, and the material recovered in aq. soln. can be further purified by extn. with Et₂O, which has the capacity for dissolving out a very active principle which depresses the arterial tension and maintains it at sub-normal levels for long periods. The depressor substance is associated with a pressor principle in the abiuret fraction. These two are sepd. during the treatment with phosphotungstic acid, since practically all of the pressor element remains in soln.

L. W. RIGGS

Superposition of the phenomena of dissociation and elective adsorption in the proteolytic diastases. L. HUGOUNENQ and J. LOISELEUR. *Compt. rend.* **181**, 149–51 (1925).—When pepsin ext. is treated with a diazotizing or other agent which reacts with its NH₂ groups, its diastatic activity is not diminished. Albumin, during digestion, when subjected to the same treatment as the pepsin, has its digestion retarded and stopped after about 30 hrs. Trypsin submitted to the reagents capable of attacking NH₂ groups is totally deprived of its digestive action. Albumins treated by the same reagents do not have their tryptic digestion stopped. Benzoylglycylglycine is not attacked by pepsin but is attacked by the total pancreatic ext. The Et ester of glycylglycine is attacked by pepsin, the NH₂ group being liberated, but in an alk. medium,

following the sapon. of the ester, the action of the pancreatic juice is not conclusive. The same is true for diacipiperazine. From the foregoing it is suggested that pepsin may be represented by the scheme $P-CO_2H$. The negative ionic micella adsorbs electively the Na ion dissociated from NaCl, allowing the Cl ion to react upon the NH_2 group of the proteins. Trypsin may be represented by the scheme $T-NH_2$. The positive micellae of the diastase take the anion of Na_2CO_3 , leaving the 2 Na ions active toward the CO_2H groups of the peptides during digestion. L. W. RIGGS

Threshold value of acid taste. HANS ROSENBAUM. *Arch. ges. Physiol.* (Pflüger's) 208, 730-1 (1925).—The strong effect of the weak acids upon taste and upon the pyloric reflex is not to be explained by any buffer action but depends rather upon the fact that the weaker acids have a peculiar ability quickly and readily to penetrate the organs of reception. G. H. S.

Colloid theory of hemolysis. FRANZ HERRMANN AND MARG ROHNER. *Arch. exper. Path. Pharm.* 107, 192-237 (1925).—Study of the effects of anions upon the colloids of the blood cell and of the hemolysis resulting shows that the sp. Hofmeister's sequence, isotonic salt solns. of the same p_H value being used, represents a true ionic effect and is not dependent upon purely H or OH activities. The degree of hemolysis given by isotonic solns. of Hg + Na salts corresponds to the tendency of the substances to form complex salts. There are 3 types of hemolytic process, (a) a lysis of the lipid or lipid-protein envelope of the cell, (b) a disturbance in the osmotic equil., and (c) a process involving the dissolving out of the hemoglobin. Lecithin hemolysis is favored by electrolytes. Inhibition or coagulation hemolysis (of the osmotic type, $-NH_4$ salts, NaH_2PO_4) is inhibited by lipid solvent hemolytic agents. Lecithin hemolysis and pure electrolyte hemolysis may be expressed as a function of the relations between the dispersive and the condensing factors, *i. e.*, adsorption and coagulation hemolytic processes, the relationships being expressed by the quotient d/s . Normally there is an equil. between s and d , but *in vitro* the magnitude of d/s may be readily modified. The dispersion of the colloids of the limiting membranes may be increased to such an extent that an adsorption hemolysis occurs, *e. g.*, lecithin hemolysis, and the hemolytic processes induced by Na oleinate, bile acids and saponin. In the other direction d/s may be so changed (diminished) by coagulation that the colloids are deprived of their function, and hemolysis by hypertonicity, by NH_4 salts, and by NaH_2PO_4 results. The increase in d by adsorptive hemolytic agents can be compensated for by an increase in s , *i. e.*, by coagulation hemolytic agents, and in a similar manner the reverse process can be demonstrated. A reduction of adsorption and increase of coagulation, increasing d/s , can be effected by lecithin in different isotonic solns. of alk. salts, by washing the red blood cells with isotonic solns. of glucose and polyvalent salts, and by feeding rabbits with cabbage. Increasing the adsorption resistance—diminishing d/s —is brought about by the presence of non-electrolytes (glucose) and certain electrolytes ($CaCl_2$, $MgCl_2$, NaH_2PO_4) in hypotonic solns.; by washing the red cells with suitable univalent salts ($NaCl$) in isotonic solns. which favor imbibition; by cholesterol; by heating of certain lecithin-electrolyte solns.; by feeding oats to rabbits; and by the presence of active syphilitic human sera. The electrolyte-lipoid relationships are of primary importance for the hemolysis or the inhibition of hemolysis by sera. G. H. S.

Water imbibition of membrane surfaces and its relation to water transport. ERNST WERHEIMER. *Arch. ges. Physiol.* (Pflüger's) 208, 669-83 (1925).—The opposite sides of the living frog membrane show differences in their capacity to take up water; thus, the outer surface swells very markedly in 0.01 *N* NaOH while the inner surface is but little affected, and with 0.01 *N* H_2SO_4 the outer side shows no swelling but the inner side swells strongly. With the chlorides of the series K, Rb, Cs, NH_4 , Li and Na in isotonic solns. KCl swells the inner side but hardly modifies the outside; NaCl exerts just the opposite effects; and NH_4Cl has approx. the same effect upon both sides. The other chlorides act as their position in the series would indicate. These differences in the behavior of the surfaces extend also to solns. of non-electrolytes. The water transfer through a membrane is dependent upon the capacities for swelling of the 2 sides in the particular soln. under consideration. G. H. S.

Physicochemical investigation of soluble proteins free from electrolytes. F. MODERN AND W. PAULI. *Anales asoc. quim. Argentina* 23, 93-148 (1925).—The combination of gluten (purified by electrodialysis) with HCl at low concn. near the isoelec. point formed gluten chloride which retained a part of the HCl in an inactive state. Blood albumin and egg albumin combine with a part of the HCl giving (1) the corresponding chloride and (2) positive and negative protein ions resulting from the combination of HCl with amphoteric ions, a combination hitherto unknown. The isoelec. point of the 3 proteins was detd. for the first time on a pure substance by the Pauli

pptn. with EtOH and electrophoresis. The theory of the Michaelis isoelec. reaction as applied to amphoteric ions is discussed. E. M. SYMMES *

Significance of the H-ion concentration in the swelling of gelatin (OSTWALD, *et al.*) 2.

B—METHODS AND APPARATUS

STANLEY R. BENEDICT

A precaution required in the tracing of melanin and hematoporphyrin in the urine. H. H. VAN DER ZOO DE JONG. *Nederland. Tijdschr. Geneeskunde* 69, II, 598-604 (1925).—Addn. of an oxidizing agent yielding a dark pptn. is often misleading; the tracing should be done by means of pptn. with Pb acetate. R. BEUTNER

The determination of urobilin and urobilinogen in the urine and in the feces (including the preparation of pure urobilin and a modification of the aldehyde reaction for urobilinogen in the urine). A. J. L. TERWEN. *Nederland. Tijdschr. Geneeskunde* 69, I, 2492-507 (1925).—T. describes a new method of reducing urobilin to urobilinogen: *The urine is mixed with an excess of a ferrous salt, preferably ferro ammonium sulfate, to which an excess of NaOH is added while stirring; the reduction takes place at room temp. in the dark, the air being excluded. After reduction, the urine is filtered; 20 cc. of the filtrate are acidified by adding a sufficient amt. of a 20% tartaric acid soln.—and extd. with 40 cc. of ether. The ether ext. is shaken 4 times with a few cc. of water for purification. Thirty cc. of this ext. is mixed with 3 cc. of satd. soln. of dimethylaminobenzaldehyde in ether, to which 10 droplets of concd. HCl is added. The mixt. is shaken intensively for 1½ min.; this causes the condensation of urobilinogen with the above-mentioned aldehyde, a purple dye being formed. Three cc. of a satd. soln. of AcONa is then added and the purple condensation product is detd. spectroscopically. For this purpose the purple soln. is dild. so much that its color is less than that of the following standard of comparison: 5 cc. satd. Na₂CO₃ soln. + 1 cc. 0.05% phenolphthalein soln. + 94 cc. water. In the whole procedure the quantities of the reagents are chosen in such a way that the final soln. contains the urobilinogen of 10 cc. of urine. In order to det. the amt. of urobilin contained in a soln. corresponding in color to his phenolphthalein standard, T. prepares pure urobilin by oxidizing a petroleum ether soln. of urobilinogen with air (by shaking it and exposing it to the light); pure urobilin ppts. as a dark green amorphous powder. He finds that a soln. of the red condensation product, equal in color to his phenolphthalein standard, corresponds to 0.406 mg. of urobilin per 100 cc. The pure urobilin was found to consist of 64.19 to 64.49% C, 7.48 to 8.23% H, 8.95-9.3% N; this would agree with the empirical formula C₈H₁₂(NO₂)ₓ. The mol. wt., as detd. by Rust's micro-method in a camphor soln., was 758; from this T. concludes that $x = 0.5$. By means of extensive control expts., T. proves his method to be entirely accurate. He shows that the Fe(OH)₃ ppt. adsorbs no urobilinogen; that the extn. with ether in the way described is sufficient; that the washing with water removes no urobilinogen from the ether soln.; and that, by the method described, urobilinogen is quantitatively transformed into the red condensation product. T. points out that petroleum ether should be used in the place of Et₂O for extn., if any oxidizing substances are present. The detn. of urobilin in the feces is done in an entirely analogous way. R. BEUTNER*

The use of the albino rat in insulin standardization. The normal blood sugar and the glycogen of the liver and muscles. L. KARCZAG, J. J. R. MACLEOD AND M. D. ORR. *Trans. Roy. Soc. Can.* 19, Sect. V, 57-61 (1925).—A series of rats, not starved, showed liver glycogen between 1 and 5%, muscle glycogen between 0.30 and 0.57%, and blood sugar between 0.113 and 0.145 mg. per 100 cc. A second series, starved 24 hrs. prior to killing, showed liver glycogen between 0.10 and 0.20%, muscle glycogen between 0.19 and 0.35% (and in 21 of 24 animals between 0.24 and 0.35%), and blood sugar between 0.096 and 0.106, av. 0.102 mg. per 100 cc. It is concluded that the rat will prove to be a more satisfactory animal for insulin assay. A. T. CAMERON

Measurement of small volumes in microanalysis. Use of the Cornu-Cottet pipet. M. NICLOUX. *Bull. soc. chim. biol.* 7, 750-2 (1925).—This pipet can be adapted to measure quantities of fluid of the order 0.1 cc. with an error not greater than 0.2%. A. T. CAMERON

Distilled water in biology. E. CANALS AND R. GENEVET. *Bull. soc. chim. biol.* 7, 673-7 (1925).—Distd. H₂O (Cu retort) was redistd. in presence of an oxidizing agent (5 drops of H₂SO₄ and 5 drops 0.1 N 1 K₂Cr₂O₇ per l., in hard glass), and then again distd. in presence of baryta (0.2 g. per l.), in the same app. During the 2nd distn. the H₂O approaches neutrality, and has a more powerful action on the glass. After 5 days' preservation even in hard glass, H₂O, whatever its origin, contains an appreciable

amt. of electrolyte. The best H_2O obtained in an all-glass app. had a cond. of 1.9×10^{-6} and p_H approx. 6.4. A. T. CAMERON

Apparatus for the measurement of carbon dioxide and of oxygen in air (modification of the apparatus of Laulanié). L. PLANTEFOL. *Bull. soc. chim. biol.* 7, 638-51 (1925); cf. *C. A.* 19, 13, 101.—Complete details of the app. and method of use are given. A. T. CAMERON

Preparation of crystallized oxyhemoglobin by ultrafiltration. L. THIVOLLE AND J. ROCHE. *Bull. soc. chim. biol.* 7, 753-4 (1925).—Dudley and Evans' procedure (*C. A.* 15, 3856) is followed until the hemoglobin is freed from stroma and completely reduced. Its soln. is then submitted to ultrafiltration in freshly prepd. 10% acetic collodion candles, connected with a water-pump. Dialysis and concn. proceed simultaneously, and after concn. to $1/2$ the original vol. Dudley and Evans' method (treatment with O_2) is continued, and oxyhemoglobin seps. without cooling, and can be removed with a Buchner funnel. A. T. CAMERON

Micro-estimation of ammonia. Application to the measurement of ammonia in urine. A. YOVANOVITCH. *Bull. soc. chim. biol.* 7, 665-72 (1925).—See *C. A.* 19, 1875. A. T. CAMERON

Estimation of uric acid in blood. M. DELAVILLE AND C. M. JONES. *Bull. soc. chim. biol.* 7, 785-96 (1925).—See *C. A.* 19, 1875. A. T. CAMERON

Ferric precipitation of proteins of fluids of the organism. H. WUNSCHENDORFF. *Bull. soc. chim. biol.* 7, 768-77 (1925).—Centrifuge the fluid to remove completely organized material. Transfer 2 cc. to a large test tube, add 20 cc. H_2O , mix, add from a buret drop by drop and very slowly with continuous shaking 15 cc. 20% colloidal $Fe(OH)_3$. If hemoglobin is present add now 0.1 g. finely powdered K_2SO_4 , still shaking. Allow to remain 15 min. Filter, refiltering the first portions. The filtrate should be limpid and colorless. Transfer 18.5 cc. of the filtrate (representing 1 cc. of the original fluid) to a Kjeldahl flask, heat with H_2SO_4 and $CuSO_4$ as usual, and nesslerize for NH_3 . A. T. CAMERON

Indirect measurement of proteins in cerebrospinal fluid and other albuminous liquids, after ferric precipitation of proteins. H. WUNSCHENDORFF. *Bull. soc. chim. biol.* 7, 778-84 (1925); cf. preceding abstract.—N is measured in the whole fluid, and after removal of proteins. Three cc. of cerebrospinal fluid is sufficient. A. T. C.

Further experiences with my chemical blood reaction for the determination of sex in human beings, animals and by the chlorophyll of plants. E. MANOILOW. *Munch. med. Wochschr.* 71, 1784-9 (1924); *Chem. Zentr.* 1925, I, 738.—A description of a no. of methods and tests to distinguish between male and female blood by means of chem. reactions. The methods are based on the assumption that there are sp. differing hormones in male and female blood. C. C. DAVIS

Dyes as microchemical reagents. H. J. CONN. *J. Chem. Education* 2, 753-5 (1925).—The reactions involved between dyes, stains and biological material are explained. The method is somewhat complicated, involving the selection of dyes that bring out some intercellular structure whose chemistry it is desired to learn, submitting the sections to the action of various solvents whose effects upon proteins, lipids or carbohydrates are known, then staining the sections with the reagent (dye) selected, and finally detg. by microscopic examn. which solvent has removed the substance under investigation. Thus stains will become chem. reagents instead of merely dyes for making microscopic structures visible. W. C. EBAUGH

Melanin and its detection in the urine. AUFRECHT. *Pharm. Ztg.* 70, 1161-2 (1925).—In the case of optically inactive samples, add a few drops of Cl water or H_2O_2 , whereupon a brownish black color immediately develops. Since this color also appears with urines rich in indican, 25 cc. of the sample should be shaken with 3 to 5 cc. of $CHCl_3$. In the presence of melanin, the color of the supernatant layer fades markedly, while the $CHCl_3$ becomes intensely blue, in the event of an excess of the oxidizing agent, reddish violet. W. O. EMERY

Estimation of iron in blood. A. RONCATO. *Arch. sci. biol.* (Italy) 6, 278-97 (1924); *Physiol. Abstracts* 10, 77-8.—The process is based on the incineration of a given quantity of blood by means of NO_2 and HNO_3 , and the transformation of the incineration product into a soln. of Fe thiocyanate; the quantity of Fe present in this is estd. by the spectrophotometric titration method. H. G.

The purification of jack-bean urease. J. B. SUMNER AND V. A. GRAHAM. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xliii-xliv (1925).—The jack-bean meal is extd. at 20° with 2 vols. of 30% $EtOH$. $EtOH$ is added to the press juice to bring it to 35% $EtOH$ and it is then centrifuged. The liquid is allowed to stand overnight at -10° the supernatant liquid decanted and the sediment centrifuged while cold. The

ppt. is stirred up in 30% EtOH soln. of phosphate of the same p_H as the original ext. The mixt. is cooled at -10° for 30 min. and centrifuged. The process is repeated five times more. The ppt. is now stirred with a small quantity of dil. H_2O soln. of neutral phosphate and seeded with crystals of concanavalin A. After 48 hrs. at $3-5^\circ$ all of the concanavalin A and B have crystd. out and are centrifuged out. The liquid is dialyzed and the product dehydrated with EtOH and Et_2O . It is of protein nature but is not identical with canavalin, concanavalin A or concanavalin B. It may be further purified by being converted into insol. urease by treatment with dil. EtOH. Cf. C. A. 19, 2677. I. GREENWALD

The determination of arginine by the use of arginase, with application to the analysis of proteins and the study of tryptic digestion. ANDREW HUNTER AND J. A. DAUPHINE. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xxxix-xl(1925).—"Under suitable conditions arginase effects a practically complete conversion into ornithine and urea. It is therefore possible to det. arginine by the successive use of arginase and urease. When 1 g. of active trypsin is added to 250 cc of a 5.5% soln. of *gelatin*, $\frac{1}{3}$ of the total arginine is split off within the first 30 min.; in 3 hrs. more than $\frac{1}{2}$ has been liberated; and by the third day an equil. has been reached, in which almost exactly $\frac{2}{3}$ of the total arginine is free." *Casein* behaves similarly, the liberation of arginine being rapid, but about $\frac{1}{3}$ of the arginine linkages resisting the action of trypsin. The liberation of arginine from *edestin* is more gradual; the process is not completed at the end of 6 days, when only $\frac{1}{2}$ is free. Applied to the soln. of bases obtained in the Van Slyke method of protein analysis, this method yielded 7.7, 7.9, 8.0, 7.9 and 7.9% arginine in *casein*, as against 8.1% by the Van Slyke method. I. GREENWALD

Direct precipitation of calcium in cow milk. CARMEN S. ROTHWELL. *J. Biol. Chem.* 65, 129-33(1925).—"Ca may be accurately detd. in cow milk by direct pptn. with $(NH_4)_2C_2O_4$, without removal of protein." This cannot be done with human milk. The results are also low with tungstic acid or CCl_3COOH filtrates from human milk. I. GREENWALD

The determination of nitrate nitrogen in plants. R. C. BURRELL AND T. G. PHILLIPS. *J. Biol. Chem.* 65, 229-34(1925).—"The various modifications of the Devarda's alloy method for the detn. of nitrate N have been found inaccurate in the presence of amide N. A modification of the phenoldisulfonic acid method has been developed which gives excellent results." The EtOH ext. of the plant tissue is evapd. to remove the EtOH, taken up in H_2O , and treated with $Pb(OAc)_2$ and NaOH. The filtrate is freed of Pb with H_2SO_4 , excess of Na_2O_2 is added and the mixt. is evapd. After neutralizing with H_2SO_4 , a final clarification with Ag_2SO_4 , $CuSO_4$, $Ca(OH)_2$ and $MgCO_3$ yields a filtrate which is ready for evapn. and treatment with phenoldisulfonic acid. I. G.

A colorimetric method of determination of bile salts in the blood. SHIRO TASHIRO. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, lxiv(1925).—"Pettenkofer's method of detection of bile salts is so regulated that the color developed is permanent enough to give ample time for colorimetric estimation. With a proper process of extn., this method is sufficiently sensitive to measure bile salts in a diln. as small as 5 in 100,000. A simple method of prepg. permanent standards, which give a perfect match to the color developed with Pettenkofer's method with the bile salts, will be given." I. G.

A method for the determination of the p_H of cerebrospinal fluid. A. T. SHOHL AND IRVINE MCQUARRIE. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xii-xiii(1925).—"The spinal fluid is obtained over Hg without exposure to air by a technic similar to that used in obtaining blood for measuring CO_2 content. The phenol red is introduced into the sampling tube, which is of the same diam. and same thickness as the comparator tubes. It is calibrated at 0.1 cc. intervals to 1 cc. and at 1 cc. intervals to 10 cc. Without transfer, the p_H is read at 38° by comparison with Sorensen's PO_4 standards and subtracting 0.03 p_H or by means of the bicolorimetric standards of Hastings and Sendroy. The CO_2 content is detd. by Van Slyke's method. By using a p_H value of 6.20, the tension of CO_2 can be calcd. I. G.

A modification of the method of preparing gliadin. D. B. DILL AND C. L. ALSBERG. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, lxxvii(1925).—"The first EtOH ext. of the gluten is evapd. under diminished pressure to small vol. and is pptd. with H_2O contg. NaCl. It is then dissolved in warm 50% EtOH and allowed to stand in the ice-chest overnight. The impure gliadin that seps. carried with it most of the lipids. The clear liquid is evapd., under diminished pressure, and the gliadin is pptd. with EtOH. The above processes are then repeated several times. In the final pptn. with H_2O , LiCl is used instead of NaCl. Five preps. from 3 different flours contained 17.55, 17.53, 17.53, 17.56 and 17.49% N, resp. The ash contents were 0.06, 0.11, 0.07, 0.07 and 0.08%. I. GREENWALD

A colorimetric micro-method for the quantitative estimation of lactic acid in blood. BRUNO MENDEL and INGEBORG GOLDSCHIEDER. *Klin. Wochschr.* 4, 1502-3(1925).—The protein is removed from 1 cc. of oxalated blood with HPO_3 . Glucose is removed with CuSO_4 and Ca(OH)_2 . The clear filtrate is heated with concd. H_2SO_4 which converts lactic acid into CH_3CHO . The addn. of veratrole gives a color whose intensity is directly proportional to the amt. of lactic acid originally present. Details are given.

MILTON HANKE

Determination of lactic acid in blood. E. SLUITER. *Klin. Wochschr.* 4, 1502 (1925).—A brief but detailed description of Harppo's method for estg. lactic acid in 5 cc. of blood (*Arch. néerland. Physiol.* 9, 461(1924)).

MILTON HANKE

The quantitative estimation of sodium thiosulfate in urine with particular reference to the use of this substance as a functional kidney test. S. A. HOLBØLL. *Klin. Wochschr.* 4, 1636-40(1925).—This work is based on that of W. Nyiri (*C. A.* 16, 3919). When $\text{Na}_2\text{S}_2\text{O}_3$ is injected intravenously a portion of it (60-70%) is oxidized to Na_2SO_4 ; the remainder is excreted, unchanged, into the urine. In nephritis, with retention, little or no $\text{Na}_2\text{S}_2\text{O}_3$ appears in the urine. This can serve, therefore, as a functional test for the kidney. If, however, the basal metabolic rate is increased, more $\text{Na}_2\text{S}_2\text{O}_3$ is formed by oxidation and erroneous conclusions might be drawn about the kidney. The urine, which must be free from pathol. constituents, is treated with animal charcoal to remove the easily oxidizable substances other than $\text{Na}_2\text{S}_2\text{O}_3$. This is not a very satisfactory method because most charcoals also absorb $\text{Na}_2\text{S}_2\text{O}_3$. (Amt. of charcoal, kind of charcoal and time of absorption are important factors, and they are fully discussed.) The sample has then to be acidified, slightly and titrated with I. Erroneous titration values are, of course, obtained in alk. soln. because of the tendency of I to give Na_2SO_4 under these conditions.

MILTON HANKE

Estimation of phosphorus and magnesium. C. P. STEWART and WM. ARCHIBALD. *Biochem. J.* 19, 484-91(1925).—The method of estg. P in urine and blood is one which has long been used in detg. P in steel—pptg. the P as NH_4 phosphomolybdate, dissolving the ppt. in standard NaOH soln. and titrating the excess alkali with standard acid (see Pemberton, *J. Am. Chem. Soc.* 15, 382(1893)). For the details the original paper must be consulted. The Mg is pptd. as NH_4 Mg phosphate, the ppt. is dissolved in HNO_3 and the P estd. as usual by the addn. of NH_4 molybdate.

BENJAMIN HARROW

The determination of hemoglobin content, erythrocyte volume and staining index of blood in tropical countries. MOHD. DJAMIL. *Geneeskund. Tijdschr. Nederland.-Indie* 65, 318-33(1925).—The Tallqvist method is dependable only for hemoglobin contents above 60%. The Sahli hematometer must be standardized every $\frac{1}{2}$ year and kept in the dark on account of the action of the tropical sun on hematin. The av. hemoglobin content of male Indonesians (Van Slyke) was 96.24%, the erythrocyte no. 5,195,000, their vol. 42.2%. Primary pernicious anemia is practically unknown among the natives; secondary pernicious anemia occurs very rarely and is mostly due to malaria, never to ankylostomiasis.

MARY JACOBSEN

Quantitative investigation in biological fluids of substances with strong surface activity. R. BRINKMAN and J. v. D. VELDE. *Biochem. Z.* 155, 187-96(1925).—Comparison of the ring and stalagmometric methods for the detn. of surface tension shows the latter to be unsuitable for accurate detns. upon dil. solns. of surface active substances. The change of surface tension of serum with increasing amts. of added Na oleate is much less marked than is the change with H_2O . A detn. of small quantities of capillary active substances consists of a direct measurement of the area of surface of a known wt. of the substance spread in a monomol. film upon H_2O . The surface tension lowering for a monomol. film of fatty acids and cholates is 1.9; for peptone and for blood, 1.7 dynes.

W. D. LANGLEY

Microdetermination of blood sugar. K. DRESEL and H. ROTHMANN. *Biochem. Z.* 157, 172-3(1925).—D. and R. believe that Diaz and Cuenca (*C. A.* 19, 2352) failed to get correct values for sugar because varying sizes of filter paper were used.

W. D. LANGLEY

Colorimetric method for the determination of oxygen. V. V. EFIMOV. *Biochem. Z.* 155, 371-5(1925).—Indigo carmine is dissolved in H_2O to give a 0.1% soln. Then glucose and K_2CO_3 are added to give a 1% soln. of each. In 24 hrs., the leuco base is formed, as shown by decolorization of the soln. Vaseline oil is poured in to form a layer over the H_2O and the flask is sealed. Special capillary pipets are used to remove the leuco base. By using varying afmts. of leuco base in the same vols. of H_2O , and exposing them to air different color standards are obtained. The soln. to be tested for O is placed with min. agitation in a tube, covered with oil, and a known amt. of leuco base added. The color developed is compared with the standards against a $\text{K}_2\text{Cr}_2\text{O}_7$ soln. as

a background. To convert to mg. O, a comparison with the method of Winckler is made. The method has the advantage of being short. W. D. LANGLEY

Studies in liver function. I. Methods for determining the concentration of bile acids and of pigments present in duodenal contents. C. W. McCLURE, ELDORA VANCE AND M. C. GREENE. *Boston Med. Surg. J.* 192, 431-3(1925).—The method for bile acids depends on the estn. of the color developed by bile acids in the presence of furfural and H_2SO_4 . The method for bile pigments depends on the estn. of the color developed by the pigments with Na_2SO_3 and glacial $AcOH$. While neither of these reactions is sp. for the substance to be detd. the conditions of the methods are such as to minimize the interference of other substances. JULIAN H. LEWIS

A comparative study of the methods for determining the blood p_H . V. MORERA AND E. SAVINO. *Compt. rend. soc. biol.* 92, 893-5(1925).—Concordant results were obtained by either the colorimetric (Cullen, Michaelis) or electrometric (Michaelis) methods. The latter is much more exact and simple. The colorimetric procedure according to Cullgn is more exact than that of Michaelis, but the prepn. and the keeping of the standards are so much easier in the Michaelis method as to make his procedure more convenient. S. MORGULIS

Means of freeing biological media of oxygen. R. LEGENDRE. *Compt. rend. soc. biol.* 92, 1431-2(1925).—It is suggested that the p_H should be readjusted after removal of the O either by aeration or boiling. S. MORGULIS

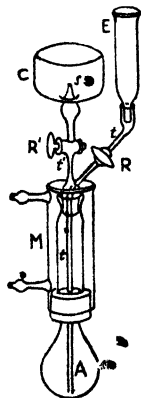
A syringe for obtaining blood samples protected from exposure to the air. MAURICE VINCENT. *Compt. rend. soc. biol.* 92, 1022-4(1925).—In an ordinary syringe the piston is hollowed out and serves as a centrifuge tube. Through a metal cap that fits over the tip of the syringe, passes a fine tube reaching to the bottom of the piston. The outside of the metal cap fits into the needle with which the venopuncture is performed. The hollow piston is filled with the required amt. of oxalate and with sufficient paraffin oil to fill the entire syringe when this is all set up. The blood is drawn directly into the piston which at all times remains filled with oil, and is centrifuged in the same tube. S. MORGULIS

Apparatus for aseptic dialysis. L. MULLER. *Compt. rend. soc. biol.* 93, 68-71(1925).—The open end of a bottle without a bottom is covered with parchment paper fastened with rubber cement. The bottle rests on a metal ring and is held firmly in position by turning wing screws through a yoke over the neck of the bottle. Through a glass tube inserted in a rubber stopper the sterilized bouillon can be introduced into the app. which has also been sterilized previously. The entire app. is then submerged in a dish contg. fresh distd. water. To det. when the dialysis of the culture medium has been completed an electric current of 12 v. is passed through it by means of wires entering the bottle at the sides of the stopper and terminating in electrodes 5 cm. apart in a U-tube within the bottle. S. MORGULIS

Determination of oxygen in the blood. MAURICE NICLOUX AND JEAN ROCHE. *Compt. rend. soc. biol.* 92, 1393-6(1925).—Ten cc. of blood is laked with 20 cc. dil. NH_4OH (6 cc. per l.) which has been previously freed from gases by boiling *in vacuo* at 35° . This laked blood is introduced through tube E contg. paraffin oil into the flask A which has been previously filled with 5 cc. of a 40% $K_3Fe(CN)_6$ soln. and evacuated at 35° to free from gases. The liberated blood gases are collected in a calibrated tube over the exit S which is submerged under water. A measured quantity of H_2 is now admitted into the tube and the mixt. is exploded. The O content represents $1/3$ of the vol. contraction. S. MORGULIS

A simple method for the study of the partition of fats in the animal organism. R. VLADESCO. *Compt. rend. soc. biol.* 93, 755-6(1925).—Place in a flask with a long neck 5 g. of the tissue to be studied and add 5 cc. H_2O and 20 cc. HNO_3 (d. 1.42). This is now boiled over a direct Bunsen flame until the tissue has completely dissolved. The material is then cooled with const. agitation to prevent the formation of lumps. It is then filtered through a weighed paper weighed together with a stoppered bottle. After drying in the oven the wt. of the fat is detd. Results are reported of fat detns. made on different organs of 6 cows. S. MORGULIS

Determination of gold in organic media. R. COQUOIN. *Compt. rend. soc. biol.* 93, 584-6(1925).—Sanocrysine, the double hyposulfite salt of Na and Au, when injected intravenously in the amt. of 0.25 g. into a normal person gives definite evidence of elimination of the Au in the urine within 10 min. after the injection, though the entire



amt. is not excreted from the system until several weeks later. The saliva also is an important portal of elimination of the Au. To det. the Au it is essential first of all to destroy the org. matter; this is done by oxidation with the usual fusing mixt. of 1 part NaNO_3 and 3 parts of Na_2CO_3 . The fused material is treated with HCl and after evapn. of the HCl is incinerated for 5 min. Even mere traces of Au, unless there is too great an excess of Fe, will impart to the powder a violet tinge, which is visible with 0.001 mg. of Au. The microchem. detn. of the Au depends upon the formation of the very insol. crystals of antipyrine chloraurate. The residue in the crucible after incineration is dissolved in a few drops of Cl water and 2-3 drops of HCl . The material is then evapd. to dryness in an oven at $100-105^\circ$. The residue should be yellow. To this is added a drop of H_2O , a very small droplet of acetic acid and 1 drop of 1:10 soln. of antipyrine, and the crystals are examd. 2-3 min. later under a microscope. By this method of assaying 0.01 mg. of Au can be detected.

S. MORGULIS

Demonstration of physiological adrenalemia by the method of Gley and Quinquaud. A. TOURNADE AND M. CHABROL. *Compt. rend. soc. biol.* 92, 1041-4 (1925).

S. MORGULIS

The catalytic effect of blood pigment on 'sodium hypochlorite; a new color test for blood. SCHYO SAKAGUCHI. *J. Biochem.* (Japan) 5, 13-24 (1925).—Blood pigments decompose NaOCl very slightly, but in the presence of glucose this is much increased. When α -naphthol is used in place of glucose a color reaction occurs which may be employed as a test for blood pigment. Similar colors are produced by Co salts which act catalytically on NaOCl . This effect of the hemoglobin is not enzymic, is not destroyed by heating and depends directly upon its Fe content. The Fe-free derivs. (hematoporphyrin, bilirubin) fail to produce this reaction. Hemocyanin, peroxidase, salts of Fe, Cu, Mn, etc., do not give this reaction either.

S. M.

A new color reaction of protein and arginine. SCHYO SAKAGUCHI. *J. Biochem.* (Japan) 5, 25-31 (1925).—Solns.: (1) 0.1 g. α -naphthol in 100 cc. 70% alc.; (2) about 5% NaOCl soln. prep'd. as follows: 50 g. KMnO_4 is put into a flask and 300-330 cc. of HCl (d. 1.17) is added by drops from a separatory funnel. The gas which develops is passed through a wash bottle contg. a little water and is then collected into a l. of 10% NaOH (cooled). This soln. should be protected from light. When to 3 cc. of a protein soln. made alk. with NaOH are added 2 drops of α -naphthol, then several drops of the NaOCl soln. a beautiful red color develops in a short time. The sensitivity of this reaction is 1:50,000 of protein, and 1:1,000,000 of arginine. Of the protein-cleavage products only arginine gives this reaction, and more particularly this reaction is due to its guanidine portion. The red substance was isolated. It is a dark brown amorphous substance, slightly sol. in H_2O , sol. in alc. or acetone, less sol. in ether and dissolves with difficulty in benzene. It is a weak acid and its alkali salts dissolve in water, producing a red color. Its elementary compn. corresponds approx. with the empirical formula $\text{C}_{23}\text{H}_{18}\text{N}_3\text{ClO}_4$. The reaction can also be utilized to detect guanidine, 0.1 mg. guanidine carbonate being thus easily demonstrated.

S. MORGULIS

Nephelometric determination of urea applicable to biological and clinical material. C. AND S. AUGUSTE. *Compt. rend. soc. biol.* 93, 629-40 (1925); cf. *C. A.* 18, 3616.—The method consists in pptg. the urea in the biol. fluid (the urea concn. should be not less than 0.01% and not more than 0.1%) with xanthidrol in a medium contg. 66% of acetic acid. After leaving the ppt. to form for an hr. the concn. of the acetic acid is brought up to 90% and the ppt. is compared in a nephelometer with a standard.

S. M.

Rapid procedure for estimating the blood urea level. C. AND S. AUGUSTE. *Compt. rend. soc. biol.* 93, 641-2 (1925).—The urea concn. in 10 cc. of blood is estd. from the amt. of ppt. formed with methyl xanthidrol.

S. MORGULIS

A method for the determination of the oxygen and carbon dioxide tensions in mixed venous blood. C. D. MURRAY AND H. TAYLOR. *Proc. Physiol. Soc., J. Physiol.* 59, lxvii (1925).—The subject empties the lungs completely and then inhales 2.5 l. of a gas mixt. (7 CO_2 , 1.5 O_2 and 91.5% N) from a rubber bag of that capacity. The gas is expired completely back into the bag, and a sample taken for analysis. The gas mixt. is rebreathed repeatedly and 5 samples are taken in all. The analysis of sample 3 or 4, or their mean, measures the venous point.

J. F. LYMAN

The circulation and its measurement. Y. HENDERSON AND H. W. HAGGARD. *Am. J. Physiol.* 73, 193-253 (1925).—The principles applied in the method are: (1) A vaporized compd. of low soly. in H_2O is absorbed from the lungs at a rate nearly in proportion to the rate at which the blood circulates through the lungs. (2) If the absorbed compd. is decomposed very rapidly in the tissues the concn. in the venous blood returning to the lungs is practically zero. (3) When conditions 1 and 2 are fulfilled, the circulation rate per min. can be calcd. as follows: Vapor absorbed per min.

÷ amt. vapor dissolved in arterial blood = circulation rate. The compd. found most satisfactory is EtI. The detns. made are: (a) the vol. of air-EtI mixture breathed per min., (b) the content of EtI in the inspired air, (c) the content in the expired air, (d) the concn. in the alveolar air. The EtI absorbed is: $a(b-c)$. The EtI content of the arterial blood is: $2d$ (the coeff. of soly. of EtI between air and blood is approx. 2). The app. is described with methods of analysis. A simplified method for obtaining alveolar air is given. The *stroke index* is defined as the ventricle output in cc. per kg. body wt. per beat. For normal persons during sitting rest, the stroke index ranges from 1.3 to 1.8. Data obtained under various conditions with normal and pathological subjects are presented. O_2 absorption and CO_2 output can be detd. with the same app. as described, the whole manipulation for one detn. requiring about 0.5 hr.

J. F. LYMAN

Principle of a method of determining the variations of dissolved carbonic acid. R. LEGENDRE. *Compt. rend.* 180, 1527-9(1925).—The content of carbonic acid in an aq. soln. depends on 3 factors, viz., p_H , the tension of the dissolved gas and the concn. of bicarbonates. The metabolism of living organisms acts on each of these factors; hence 2 or preferably 3 factors should be detd. Air deprived of CO_2 is bubbled through the liquid and the CO_2 carried out of the liquid is collected and detd. The p_H of the liquid thus treated is detd. to control its stability in non-volatile ions. These 2 detns. made simultaneously upon 2 solns. at first identical, but in one of which an organism has lived for a certain time, give an accurate knowledge of the CO_2 exchanges of the organism with its medium.

L. W. RIGGS

Application of the nomographic method to the study of respiratory phenomena in the blood. L. J. HENDERSON. *Compt. rend.* 180, 2066-7(1925).—The diagrams shown represent the physico-chem. properties and relative circulatory phenomena in a normal subject and in a subject affected with a congenital malformation of the heart which is indicated by the fact that a part of the blood does not pass through the lungs. The data from which the scales were constructed include total O, total CO_2 , free O, free CO_2 , alky. of the plasma, numerical relation of the concn. of the anions in the corpuscles to the anions of the plasma and vol. of the corpuscles. The resulting alignments show the compn. of arterial, venous and oxygenated pulmonary blood.

L. W. RIGGS

Biochemical determination of insulin. FERNAND WYSS. *Compt. rend.* 181, 327-8(1925).—The titration of insulin *in vitro* is based on the facts: (a) glucose is oxidized to lactic acid by H_2O_2 , but not in the presence of insulin; (b) phenols are oxidized by H_2O_2 , but in the presence of insulin this oxidation is retarded or prevented except in the polyvalent phenols having 2 hydroxyls in the *o*-positions; (c) insulin prevents the formation of ketonic substances which result from the oxidation and decamination of amino acids or the oxidation of β -hydroxybutyric acid. In (b) the protection of phenols against oxidation depends on the quantity of insulin present. One cc. of insulin contg. 10 clinical units is dild. with 19 cc. of water (p_H 7.5), and 1 cc. of this dild. is placed in each of a series of 8 tubes with 1 cc. of a freshly prepd. 0.2% soln. of resorcinol. A control tube contains no insulin. To the tubes of the series is added 0.25, 0.50, 0.7, cc., etc., of H_2O_2 (1 cc. H_2O_2 equiv. to 24 cc. 0.01 N $KMnO_4$) and the liquid in each tube is made up to 5 cc. with water having a p_H 7.5. The tubes are then allowed to stand in boiling water for 20 min. when the control tube is brown, also the tube which received 2 cc. of H_2O_2 is brown, while the tube which received 1.75 cc. of H_2O_2 is colorless. Thus 0.5 unit of insulin is neutralized by 2 cc. of the H_2O_2 .

L. W. RIGGS

Manoilov's reaction for identification of the sexes. SOPHIA SATINA AND M. DEMEREC. *Science* 62, 225-6(1925).—This paper is an abstract of Manoilov's "Identification of the sexes in dicious plants by chemical reaction," *Bull. Appl. Bot. and Plant-breeding* 13, (2) 503-5(1923), and of Grunberg's addn. to the paper under the same title, *Ibid* 506 (both in Russian). The solns. used were: (1) 1% aq. papayotin, (2) 1% alc. soln. of Dahlia or Grubler's methyl green, (3) 1% aq. $KMnO_4$, (4) 40% soln. HCl, (5) 2% aq. soln. thiosinamine. To 3 cc. of 10 to 20% blood 10 drops of (1) are added, in 1 to 3 min., 3 drops of (2), then 10 drops of (3), 1 to 3 drops of (4) and 5 drops of (5). After the addns. of (1), (2) and (3) the material is stirred not shaken, and after the addn. of (4) and (5) it must be shaken. The male blood soon becomes colorless or nearly so, while the female blood remains reddish violet. Analogous results were obtained with chlorophyll freshly extd. with 30 to 60% alc. from certain dicious plants.

L. W. RIGGS

Color reactions of tryptophan with aldehydes. A. BLANCHETIÈRE. *Compt. rend.* 180, 2072-4(1925); cf. Romieu, C. A. 19, 1876.—With pure tryptophan Romieu's reaction with sirupy H_3PO_4 could not be obtained but instead a pale yellow color with a faint green fluorescence. In general H_3PO_4 , in the presence of traces of various sugars

and of other substances having an aldehydic function, gives the reaction described by Romieu. Aromatic aldehydes as a rule give a more brilliant coloration than do aliphatic aldehydes. The blue or violet colorations shown by tryptophan are not given by glycine, alanine, valine, leucine, phenylalanine, tyrosine, aspartic acid, glutamic acid, serine, proline, cystine and histidine.

L. W. RIGGS

Critical examination of Bang's sugar determination method. P. G. NORDSTRÖM. *Svensk Farm. Tids.* 29, 409-15(1925).—Bang's method gives accurate results but certain precautions are necessary. Bang's reagent does not keep. The CuCl_2 soln. must not be colorless nor become colorless in the reduction. It is necessary to make a blank titration on the reagents. The method is not reliable if more than 10 mg. glucose is present. The time of heating should be inverse to the concn. of glucose; from 7 min. for 0.5 mg. to 4 min. for 10 mg. It is well to make a preliminary detn. to ascertain the optimum time for the reduction. All urines give a titrable reduction which is not glucose. Urine should always be diluted 10 times before the detn. of glucose. There should be a titration on the reaction mixt. which has not been heated and these figures should be subtracted from the regular titration after heating. This non-glucose blank comes to about 0.25 cc. 0.025 N I soln.

A. R. ROSE

Method for sampling dust in alveolar air. R. M. THOMSON. *J. Ind. Hyg.* 7, 385-90(1925).—Detn. of size, number and microscopic character of dust particles in exhaled air is made by a combination of Owen's jet dust counter, Koyze's konimeter or Hill's dust counter with Haldane's alveolar air sampler.

C. M. SALLS

Simple method for the determination of the total gas metabolism in artificially ventilated animals. J. G. DUSSER DE BARENNE AND G. C. E. BURGER. *Arch. ges. Physiol.* (Pflüger's) 209, 120-1(1925).—The app. is illustrated and described.

G. H. SMITH

Determination of amino acids in blood. V. MORERA. Buenos Aires, *Pamphlet* 1924, 24 pp.; *Anales asoc. quim. Argentina* 13, 73(1925).—M. finds that the Van Slyke method gives very good results with solns. of pure amino acids but not with blood because the large amt. of blood required makes it difficult to run a series of tests on the same subject and the evapn. of the de-albuminized liquid to reduce it to a small vol and the operations required perfectly to eliminate urea make the method long and complicated. The Folin method is better because it does not require more than 1 cc of blood, is very sensitive, and the results are not affected by the presence of urea.

E. M. SYMMES

Estimation of small amounts of reducing sugars in urine. F. WOKES. *Pharm. J.* 115, 127-31, 177; *Chemist & Druggist* 103, 172-4(1925); cf. *C. A.* 18, 3402.—Accurate detns. of small amts. of reducing sugars in urine are important in life insurance matters and in detecting incipient disease. Cole's micro-method for detg. sugar in blood (cf. *C. A.* 18, 1509) is well adaptable to its detn. in urine. Minute precautions are given for the following steps: Removal of creatinine, glucuronic acid, etc., with Patein-Dufau's reagent; method of detg. proper diln. to attain in the reaction mixt. the optimum concn. of 0.0002-0.0015% of sugar, then mixing the dild. urine with Cole's alk. Cu -iodate soln. Boil in a standard app. for a definite period, add dil. H_2SO_4 , cool, add 2 drops of 10% soln. of KI and titrate the liberated I with 0.005 N $\text{Na}_2\text{S}_2\text{O}_3$ and a 1% soln. of sol. starch. Subtract the result from that of a blank detn., and with this result read from a table the % of sugar in the original urine. Since the daily diet readily affects the sugar content of urines even of healthy persons (normally 0.05-0.20%), part-day samples are misleading; av. results are obtained only with 24-hr. samples.

S. WALDBOTT

Relative reducing powers of some common sugars. A. W. ROWE AND BERTHA S. WIENER. *J. Am. Chem. Soc.* 47, 1698-701(1925).—No 2 of the simple reducing sugars have the same reaction velocity. With the methods of blood analysis in which time is specified and the reaction is incomplete, this may introduce an error of significant magnitude. The reduction coeffs. for several sugars in aq. soln. have been detd. by both the Folin-Wu and modified Lewis-Benedict methods. In mixts. of sugars, the reduction is proportional to the relative amts. of the several compds. and the reducing power of each. The time element of reduction is highly variable. Reduction values obtained in aq. soln. are the same as those in plasma. The data are shown as a set of curves.

C. J. WEST

Proline and tryptophan as factors influencing the accuracy of Van Slyke's method for the determination of nitrogen distribution in proteins. R. A. GORTNER AND W. M. SANDSTROM. *J. Am. Chem. Soc.* 47, 1663-71(1925).—In the absence of tryptophan (I) and of proline (II) and without previous boiling of the NH_2 acids, the method yields essentially correct results, thus confirming the original work of Van Slyke. When a mixt. of 14 amino acids (not including I or II) is boiled for 24 hrs. prior to analysis,

the resulting analysis shows that approx. 35.5% of the cystine N is not pptd. by phosphotungstic acid, causing a corresponding loss in the NH_2 N of the bases. There is a gain in the NH_2 N. When I is added to the above mixt. (no II), the analysis of the unboiled sample showed appreciable errors in the basic fraction and in the NH_2 N and the total N of the filtrate from the bases. The error in the basic N affects chiefly the arginine fraction. When this mixt. is boiled, there are errors in the histidine and cystine fractions of the bases (cystine 37.9% not pptd.), in the NH_2 fraction and in the filtrate from the bases. When II but not I is present, the unboiled mixt. showed errors in both the basic fraction and in the fraction from the filtrate of the bases. Apparently phosphotungstic acid ppts. a part of the proline with the diamino acids. This proline N distributes itself between the arginine and the histidine fractions, and because of its entire lack of NH_2 N, the calcons. of Van Slyke's method cause the lysine fraction to show a loss. When the mixt. is boiled, the basic fraction still far exceeds the calcd. values, with a corresponding decrease in the fractions of the filtrate. Cystine is only partially pptd. (73.3%) and the NH_2 N is increased. In general the data show that both I and II produce errors in Van Slyke's N distribution if they are present in a protein or a mixt. of NH_2 acids. The cystine value of a Van Slyke analysis on a 24-hr. protein hydrolysate may be taken to represent approx. 65% of the true cystine N present in the unboiled material.

C. J. WEST*

Apparatus for measuring oxygen consumption in the study of metabolism. F. G. BENEDICT and C. G. BENEDICT. U. S. 1,550,335, Aug. 18.

Preserving animal tissues and other biological material. C. S. MINER. U. S. 1,554,641, Sept. 22. Furfural is used for preserving specimens for dissection, etc. U. S. 1,554,642 specifies the similar use of pyromucic acid.

C—BACTERIOLOGY

A. K. BALLS

Medium for inhibition of "spreaders" and differentiation of *B. coli* and *B. aerogenes*. C. E. SKINNER and T. J. MURRAY. *J. Infectious Diseases* 34, 585; *Am. J. Pub. Health* 14, 713 (1924).—"Spreaders" were successfully eliminated without inhibition of *B. coli* and *B. aerogenes* by addn. of Crystal Violet to Levine's Eosin-Methylene Blue agar in proportion 1:100,000, thus facilitating the differentiation of the organisms named.

B. C. A.

Biochemistry of *Vibrio cholerae*. J. HIRSCH. *Z. Hyg. Infektionskrankh.* 102, 503-16 (1924).—In aq. peptone cultures *Vibrio cholerae* reduces nitrate quantitatively to nitrite. The reduction is independent of the initial development of the vibrio. The velocity of reaction increases with the time and with the concn. of nitrate up to 0.3%. (a) from the nitrate cannot replace deficient atm. O.

B. C. A.

Studies on the sulfur bacteria. L. G. M. BAAS-BECKING. *Ann. Botany* 39, 613-50 (1925).—An exhaustive study in which the members of the group are classified on the basis of physiol. characters and the phys. and chem. conditions for their growth considered in detail. The outstanding conclusion of interest to the chemist is the proof presented that these forms do not derive their energy from the oxidation of H_2S , since the free energy level of S is higher than that of aq. solns. of H_2S . The dehydrogenation of the hydrosulfide ion is a more probable source of energy. For the evidence the original must be consulted.

JOSEPH S. CALDWELL

Hydrogen-ion concentration vs. titratable acidity in culture media. A. J. QUIRK and E. H. FAWCETT. *J. Infectious Diseases* 33, 1-59 (1923); *Expt. Sta. Record* 50, 802.—

An extensive investigation of the relationship between the titratable acidity of peptone beef infusion broth as expressed in Fuller's scale and the corresponding p_{H} values. As a starting point in the comparison the p_{H} values of the phenolphthalein end points ordinarily used in the titration were detd. electrometrically. The first change took place at p_{H} 7.8, a faint but decided pink color developed at p_{H} 8.2, and a rose pink at p_{H} 8.4. A chart is given of these colors. The necessity is emphasized of a consistent choice of color in detg. the end point in phenolphthalein titrations. Conclusion: If a uniform method is used in the prepn. of peptone beef infusion broth titratable acidity may be interpreted in terms of p_{H} . If the infusion is prepd. in the cold by adding water equal to 2 times the weight of the beef or in the hot by adding water equal to $2\frac{1}{2}$ times the weight of the beef, making up the vol. in each case after filtering, the Fuller's scale values may be translated into p_{H} values by the use of the formula $8.2 - (F/10) = p_{\text{H}}$, in which F equals the given Fuller value. In titrating media, a standardized technic is considered as essential as in making colorimetric or electrometric H-ion concn. detns. Directions are given for the adjustment of medium over a range broad enough to cover

*almost any need of the plant or animal pathologist and for adjusting to any given Fuller's scale value any finished autoclaved beef infusion broth. The same relation of scales is thought to hold good for all standard media based on a 1% peptone beef infusion, with the exception of gelatin in the extreme ranges, especially on the acid side. The principles covering the correction of beef infusion media do not apply to beef ext. media, in the adjustment of which knowledge of the p_H value is considered to be useful.

H. G.

Formation of peroxide by *Actinomyces necrophorus* on exposure to air in relation to anaerobic plate cultures. WM. A. HAGAN. *J. Infectious Diseases* 35, 390-400(1924); *Abstracts Bact.* 9, 46.—*Actinomyces necrophorus* produces sufficient H_2O_2 when young vigorous cultures are exposed to the air in shallow layers to give a relatively strong test with benzidine and fresh potato. Estn. of the amt. indicates about 0.1%. The peroxide formed is relatively unstable. This concn. of produced peroxide or of peroxide added to the medium is enough to inhibit or cause a marked lag in growth. The same phenomenon is assumed to occur when growth is inhibited in anaerobic plate cultures, because of the exposure to air in the process of plating, while in shake cultures of the same medium good growth occurs.

H. G.

A possible role of pyruvic acid in bacterial growth. J. H. QUASTEL. *Biochem. J.* 19, 641-4(1925).—A mol. which is activated by *B. coli*, which can give rise to pyruvic acid and which in its reactions (oxidation, etc.) can liberate energy, may serve as a source of nutrient C to *B. coli*. The action is demonstrated by the resting bacteria-methylene blue method (see *C. A.* 19, 3283). A mol. which is not activated by *B. coli* but which can give rise to pyruvic acid cannot serve as a nutrient C supply (e. g., malic acid). A mol. which is activated by *B. coli* but which cannot give rise to pyruvic acid cannot serve as a nutrient C supply (e. g., formic acid).

B. HARROW

Dehydrogenations produced by resting bacteria. II. J. H. QUASTEL AND M. D. WHETHAM. *Biochem. J.* 19, 645-51(1925). (Cf. *C. A.* 19, 3283).—The behavior of a no. of amino acids, sugars and related substances in the presence of resting *B. coli* as the activating source and of methylene blue as the H acceptor is described. III. J. H. QUASTEL AND W. R. WOOLDRIDGE. *Ibid* 652-9.—*B. alkaligenes* shows only feeble activating powers, reducing effects (with methylene blue as H acceptor) being greatest with formic, lactic, α - and β -hydroxybutyric acids. *B. prodigiosus* possesses powerful activating properties. *B. proteus* is less powerful than the other two.

BENJAMIN HARROW

Further observations on the anaerobic growth of bacteria. J. H. QUASTEL AND MARJORY STEPHENSON. *Biochem. J.* 19, 660-6(1925). (Cf. *C. A.* 19, 3103).—The anaerobic growth of certain bacteria has been found possible when the organism activates some constituent of the medium as a H acceptor.

BENJAMIN HARROW

Observations on d'Herelle's bacteriophage. MAX S. MARSHALL. *J. Infectious Diseases* 37, 126-60(1925).—Quant. data are given regarding the mutual relationship between bacterial cells and bacteriophage. Studies of certain corollary features were also made from a quant. point of view such as the absorption of bacteriophage, its diffusion through agar and semipermeable membranes, the resistant strains, and the lysed culture as antigen. The facts obtained support the theory that bacteriophage is a living ultramicroscopic entity.

JULIAN H. LEWIS

The germicidal properties of soap. J. E. WALKER. *J. Infectious Diseases* 37, 181-92(1925); cf. *C. A.* 19, 2220.—While not markedly bactericidal, any ordinary soap is active enough so that in the process of a thorough washing of the hands with the formation of a good lather any adhering diphtheria bacilli, streptococci and pneumococci are killed. Coconut oil soap is the only soap that will kill typhoid bacilli and this occurs only when the hands are washed for 3 min. with an exceedingly thick lather. The germicidal action of soap is enhanced by raising the temp. Foreign substances interfere markedly with the germicidal activity of soap.

JULIAN H. LEWIS

The formation of acetylmethylcarbinol and 2,3-butyleneglycol in the course of sugar fermentation by alcohol yeasts and true lactic acid bacteria. A. J. KLUYVER AND H. J. L. DONKER. *Verslag Akad. Wetenschappen Amsterdam* 33, 915-9(1924); *Proc. Acad. Sci. Amsterdam* 28, 314-7.—The absence of acetylmethylcarbinol (I) and 2,3-butyleneglycol (II) from normal fermentation liquids is surprising, since Neuberg and Reinfurth have demonstrated the formation of I from the normal intermediate AcH by the carboligatic action of yeast. According to Harden 20-30% I are formed in sugar fermentation by *B. lactis aerogenes*. The assumption that AcH is reduced by the yeast protoplasm before it undergoes condensation was experimentally confirmed. II was found in glucose-yeast fermentation liquids, to which methylene blue or S has been added as H-acceptor. The former was reduced to the leuco compd., the latter to H_2S .

II was also produced by *Lactobacillus fermenti* and "*Betabacterium breve* (Orla-Jensen)" • from levulose, which was suitably used as substrate and acceptor. When subjected to fermentation by alc. yeasts levulose also gave a strong AcH and II reaction in contrast to the glucose controls. The detection of mannite under these conditions is almost impossible, but the presence of II makes the formation of mannite very probable.

MARY JACOBSEN

The change of the buffering, and the amino nitrogen increase by bacterial action upon some food substrates. L. BLEYER. *Biochem. Z.* 157, 220-8(1925).—The change of amino N and the buffer value of substrates at $p_{H} = 5$ or 6, inoculated with *B. pyocyaneus*, *prodigiosus* and *proteus*, show, that alkali is formed, whereas with enzymes acid is formed instead. But when glycerol is present, acid is formed by the bacteria. The consumption of O by coagulated sheep serum is increased by *pyocyaneus*. Casein is hydrolyzed by each strain at a different rate.

W. D. LANGLEY

Effect of peptone on the phagocytosis of trypanosomes in frog lymph. BERTHE FRER. *Compt. rend. soc. biol.* 92, 1422-3(1925).—Peptone injections cause a marked retardation of phagocytosis in the frog. Effect of peptone on the phagocytosis of diphtheria bacilli in frog lymph. *Ibid* 1424-5(1925).—Injection of peptone causes retardation of the *in vivo* phagocytosis of diphtheria bacilli which varies with the dose injected.

S. MORGULIS

Effect of bile on bacteriophage and the importance of this action. G. CALALB. *Compt. rend. soc. biol.* 92, 1442-3(1925).—Bile even in small concn. has the property of arresting the lytic action of bacteriophage which, however, is not itself destroyed and may be recovered from the filtrate of the culture.

S. MORGULIS

Effect of sodium chloride on bacteriophage. J. DA COSTA CRUZ. *Compt. rend. soc. biol.* 93, 37-8(1925).—Pure active bacteriophage added to satd. NaCl soln. and filtered through a Chamberland candle has only 0.1 of its original activity. When a 1% satd. NaCl is used there is no alteration of the lytic power before and after filtration. The flocculation of the bacteriophage which is also observed with H₂O is thus regarded as being due to its nature of a colloid resembling a globulin.

S. MORGULIS

Effect on bacteriophage of electrolytes and of the hydrogen-ion concentration of the medium. FERNAND ARLONG and CHAVANNE. *Compt. rend. soc. biol.* 93, 531-2(1925).—The presence of electrolyte is necessary for the bacteriolysis, but cannot cause it alone. Therefore, this lysis is not simply a chem. effect. The H-ion concn. may be varied without suppressing the bacteriophage lytic action, which proceeds even in an acid medium.

S. MORGULIS

The transformation of sulfur to sulfate by means of bacterial association. G. GUITTONNEAU. *Compt. rend.* 181, 261-2(1925).—The presence of NH₄ succinate in a synthetic nutritive medium favors the production of hyposulfites from S by a micro-organism which G. has designated as MM₁ and ET₂. Another organism which resembles *Bacillus subtilis* will transform the hyposulfites to sulfates in the same medium in the presence of NH₄ succinate. These 2 species separately will accomplish their resp. roles, the first changing S to hyposulfites, and the second changing the hyposulfites to sulfates. When grown in the same medium at the same time, the complete transformation from S to sulfates is accomplished at once. They were grown at 20° to 22° for 35 to 40 hrs. to complete this change.

G. F. REDDISH

The peptonization of plant materials and its application in bacteriology. R. M. SNYDER. *Abstracts Bact.* 9, 140(1925).—Peptonization was conducted as follows: Air-dried plant material in convenient amts. is pushed into the bottom of a test tube and enough Se oxychloride added to cover the tissue and then heated gently over a low flame. After peptonization is completed, the soln. is cooled and poured into a l. of sterile distd. H₂O, and allowed to settle overnight. In the morning the clear supernatant liquid is decanted into the Se waste bottle and the pptd. material centrifuged. After repeated washing the peptonized material is taken up in 5 cc. of H₂O. Small quantities of this material may be added to the Petri dish cultures when the plates are poured. Precautions must always be taken to maintain sterility. This material increases the growth of certain plant pathogens.

F. W. TANNER

The spectrophotometer and the standardization of dyes. R. E. SCOTT and R. W. FRENCH. *Abstracts Bact.* 9, 141-2(1925).—To devise means of more accurately detg. specifications under which bacteriol. dyestuffs could be standardized, the spectrophotometer was adopted for analyzing the absorptions spectra resulting from the soln. of the dye in a suitable solvent. By this means a study is being made of the products of different makers.

F. W. TANNER

Surface tension as a factor in the growth of *Lactobacillus acidophilus* and *Lactobacillus bulgaricus*. W. R. ALBUS and G. E. HOLM. *Abstracts Bact.* 9, 142

- (1925).—*L. acidophilus* will grow in a soln. with a surface tension as low as 30 dynes while *L. bulgaricus* in the same medium with a surface tension depressed to 40 dynes showed no growth after 7 days at 37°. Thus it is possible to differentiate between these closely related organisms by means of this method. Surface tension may also be a factor in the implantation of these organisms in the intestines. F. W. TANNER

Bacteriophage of d'Herelle. II. Effect of alcohol on the bacteriophage of d'Herelle. J. J. BRONFENBRENNER AND CHARLES KORB. *J. Exptl. Med.* 42, 419-29 (1925); cf. *C. A.* 19, 840.—When bacteriophage is pptd. by EtOH at room temp. its activity rapidly and progressively decreases until it is totally destroyed, between 6 and 24 hrs. after exposure. If the pptn. is carried out at 7° the destruction of lytic activity is considerably slower; measurable traces may be detected even after 4 weeks' exposure to EtOH. Although the major portion of the lytic activity is found in the ppt., the supernatant EtOH carries a measurable amt. of lytic principle which remains active for several days. In all cases the residual lytic activity was found to be transmissible in series. The inactivation of bacteriophage by EtOH seems, therefore, analogous to the alc. inactivation of certain enzymes and toxins. C. J. WEST

D—BOTANY

B. M. DUGGAR

Changes in sugar content and rate of growth of beets as the result of variations in precipitation. JOSEF URBAN. *Z. Zuckerind. Cechoslov. Rep.* 49, 299-305, 307-12 (1925); *Listy Cukrovar.* 43, 222ff (1925).—A dry week following a wet week showed the greatest increase in sugar (up to 1.19%). Two dry weeks in succession showed less gain in sugar. If the pptn. was over 27 mm. in one week, the next week showed no increase in sugar. Rate of growth is directly proportional to pptn. W. L. BADGER

The development and distribution of chlorophyll in roots of flowering plants grown in the light. DORIS POWELL. *Ann. Botany* 39, 503-13 (1925).—Most roots are potentially capable of developing chlorophyll; it appeared in roots of 13 out of 16 species when the roots were grown under strong elec. light. Its location and extent is const. for the species but varies from species to species. Development of chlorophyll occurred equally well in tap water, culture solns., or damp air, so that aeration is not a governing factor. Well-developed plastids were present everywhere in the root cortex, whether grown in light or in dark, but were larger in roots grown in light. J. S. C.

Plant electricity. I. Photoelectric currents associated with the activity of chlorophyll in plants. J. C. WALLER. *Ann. Botany* 39, 515-38 (1925).—Continuing the work begun by A. D. Waller in 1900 W., has studied the photoelec. currents developed between illuminated and shaded portions of the same leaf. These currents originate in the chlorophyllose region of the leaf as albino leaves, white petals and non-chlorophyllose parts do not show them. The direction of the current in most dicotyledonous plants is from illuminated to shaded part of the leaf during illumination, reversing after illumination ceases, but it is opposite in direction in some trees and in monocotyledons which do not store starch in the leaves. Its direction is detd. partially by the sp. nature of the leaf, partially by previous treatment. JOSEPH S. CALDWELL

Some observations on the action of radium on plant cells. MAUD WILLIAMS. *Ann. Botany* 39, 547-62 (1925).—Epidermis and attached chlorophyllose cells of petioles of *Saxifraga umbrosa* were exposed to irradiation with β - and γ -rays for varying periods. The initial effect was an increase in circulatory rate, followed by increase in amplitude of Brownian movement, suggesting lowered viscosity. Later the cytoplasm shrank away from the walls, granulation occurred, and the permeability of the protoplasm increased while osmotic pressure decreased on account of the escape of solutes. Vacuolation and discoloration occurred upon longer exposure. The effects are in all cases irreversible. The results of treatment with β - and γ -rays are strikingly like those produced by the softer X-rays. A rather definite relation between intensity and time of exposure was demonstrated. Plant material varies widely in its susceptibility at different seasons of the year. JOSEPH S. CALDWELL

Studies on the tissues concerned in the transfer of solutes in plants. The effect on the upward transfer of solutes of cutting the xylem as compared with that of cutting the phloem. O. F. CURTIS. *Ann. Botany* 39, 573-85 (1925).—The movement of solutes, both upward and downward, occurs chiefly through the phloem and is hastened by the protoplasmic streaming movements within the cells. JOSEPH S. CALDWELL

Polarized light and starch grains. W. NELSON JONES. *Ann. Botany* 39, 651-3 (1925).—The conclusion of Baly and Semmens (*C. A.* 19, 781) that hydrolysis of starch

grains by diastase is accelerated by polarized light or brought about by the light without, enzyme is questioned. Starch grains are unevenly attacked by diastase and visual inspection cannot precisely est. the extent of soln. The appearance of grains figured by the authors is that of grains ruptured or deformed by pressure. Jones has been unable to obtain evidence from repetition of the expts. that polarized light has any effect upon starch either with or without the presence of diastase.

JOSEPH S. CALDWELL

Relation of growth of *Helminthosporium sacchari* to maintained temperatures. F. E. HALMA AND H. S. FAWCETT. *Phytopathology* 15, 463-9(1925).—Growth on nutrient agar occurred at all temps. between 13.5° and 32.0° but the optimum lay between 20° and 29°. At the optimum temp. standard bouillon became distinctly alk but was only slightly altered in p_H at temps. at which growth was slight.

JOSEPH S. CALDWELL

High evaporation, a precursor and a concomitant of Western yellow tomato blight. MICHAEL SHAPLOV. *Phytopathology* 15, 470-8(1925).—By a study of the monthly climatological data for several of the Western States, in conjunction with reports of occurrence of Western yellow blight of tomatoes in the same area, a very definite correlation is established between max. evapn. rates and severe outbreaks of the disease. A drop to a low level of evapn. rate is attended by checking of the disease and more or less complete recovery of plants already affected.

JOSEPH S. CALDWELL

Proteins of the bark of the common locust tree, *Robinia pseudacacia*. I. Enzymes associated with the proteins: the composition, properties, nitrogen distribution, and some of the amino acids of the albumin. D. BREESE JONES, C. E. F. GERSDORFF AND O. MOELLER. *J. Biol. Chem.* 64, 655-71(1925).—"There have been isolated from the air-dried, inner bark of the common locust tree, *Robinia pseudacacia*, 2.52% of albumin and 1.38% of globulin (calcd. on the basis of H₂O-free bark). A significant quantity of a substance having the properties of a protease was also obtained. Successive exhaustive extrns. with H₂O, 10% NaCl, 70% EtOH and 0.5% NaOH removed from the coarsely ground bark 66.06% of the total N, equiv. as protein (N \times 6.25) to 11.56% of the bark. The small quantities of N extd. by EtOH and alkali were non-protein in character, showing the absence in the bark of proteins of the prolamine or glutelin type. By making a NaCl ext. of the bark 0.44 satd. with (NH₄)₂SO₄, practically all of the protein was pptd. The mixed proteins thus obtained had enzymic properties, capable of decomp. urea and amygdalin. Working with the isolated proteins, the enzymes were found to be associated with the globulin and not with the albumin or protease. The albumin, ether in H₂O or NaCl solns., coagulated at 62-63° and had the decompn.: C 54.52, H 6.83, N 14.77 and S 0.80%. Analysis by the Van Slyke method showed it to contain arginine 4.39, histidine 1.74, lysine 5.45 and cystine 1.37. Colorimetric estns. of cystine, tyrosine and tryptophan gave 1.03, 6.27 and 4.18%, resp. There were obtained by actual isolation 7.72% aspartic acid and 4.48% glutamic acid."

I. GREENWALD

Proteins of the cottonseed. D. BREESE JONES AND F. A. CSONKA. *J. Biol. Chem.* 64, 673-83(1925).—"By extg. finely ground cottonseed kernels (hull-free) with C₆H₆, nearly all of the fatty and resinous substances and much of the coloring material are eliminated, thus facilitating the subsequent extn. of the proteins by different solvents. For this purpose C₆H₆ is far superior to Et₂O. Two globulins, designated as α - and β -globulins, have been sepd. from a NaCl ext. of cottonseed in yields of 2.59 and 16.00%, resp. The α -globulin was pptd. by the addn. of (NH₄)₂SO₄ to 0.4 to 0.5 satn. It coagulated at 95-97°. The β -globulin sepd. at a satn. of 0.7 to 0.8, but only when the ext. had previously been dild. with H₂O. It coagulated at 92-93°. Two preps. having similar properties and compns. were sepd. from the NaCl ext. by heating to 62° and 85°. These fractions yielded 68.2 and 67.52% of ash, which had the following compn.: P₂O₅ 57.29, CaO 9.71, MgO 16.62 and Na₂O 13.90%." 2.08% of a pentose protein was also isolated by evapg. the filtrate from the dialyzed globulins *in vacuo* and pptg. with EtOH. This contained pentose 16.57, P 0.194 and N 12.64%. Analysis by the Van Slyke method showed that the N of the α -globulin comprised amide N, 1.40, humin N 1.66, cystine N 0.54, arginine N 22.90, histidine N 5.27, lysine N 4.07, amino N in filtrate 51.53 and non-amino N in filtrate 2.58%. For the β -globulin, these figures were 11.70, 1.87, 0.51, 23.94, 6.15, 4.36, 50.11 and 1.00 and for the pentose protein they were 12.99, 4.62, 1.43, 23.02, 3.09, 8.54, 43.93 and 1.03, resp. "A small quantity of a substance having the properties of a glutelin was also isolated. An attempt to isolate a nucleic acid gave negative results."

I. GREENWALD

Some nitrogenous constituents of the alfalfa plant. IV. The betaine fraction. H. B. VICKERY. *J. Biol. Chem.* 65, 81-9(1925); cf. C. A. 18, 3407; 19, 2063.—The "alfalfa filtrate" was pptd. with Ba(OH)₂ and EtOH and the filtrate, after removal of

- the reagents, was treated with $\text{Hg}(\text{NO}_3)_2$ and Na_2CO_3 . The filtrate was pptd. with phosphotungstic acid. This ppt. contained 8.48% of the N of the "alfalfa filtrate." Of this 6.09% was present as *stachydrine*, 0.58% as *choline*, 0.13% as NMe_3 and 0.049% as betaine. Stanek's periodide reagent was found to ppt. considerable *stachydrine* together with choline at alk. reaction. V. The basic lead acetate precipitate. H. B. VICKERY AND C. G. VINSON. *Ibid* 91-5.— $\text{Pb}(\text{OH})\text{OAc}$ pptd. from "alfalfa filtrate" as much as 29% of the N. After decompn. with H_2S and hydrolysis with H_2SO_4 , the Pb ppt. yielded appreciable quantities of adenine, arginine, lysine, *stachydrine*, aspartic acid and tyrosine. I. GREENWALD

Growth of wheat roots in salt solutions containing essential ions. S. F. TRELEASE AND H. L. TRELEASE. *Bot. Gaz.* 80, 74-83 (1925).—Marked retardation of root elongation did not occur unless the vol. mol. concn. of at least 1 of the nutrient salts, $\text{KH}_2(\text{PO}_4)_2$, $\text{Ca}(\text{NO}_3)_2$ and MgSO_4 , constituted less than about 15% of the total vol. mol. concn. of the soln. BENJAMIN HARROW

Hydrolytic enzymes in *Phormidium laminosum*. OLGA LAKEŁA. *Bot. Gaz.* 80, 102-6 (1925).—The alga growing in Hymen Terrace at 74° was identified as *Phormidium laminosum* (Ag). *Phormidium* does not contain diastase, invertase or a casein-splitting enzyme, but it does contain lipase. BENJAMIN HARROW

• The ripening of seeds. A. BLAGOVESHENSKA. *Biochem. Z.* 157, 201-19 (1925).—Seeds of *Vicia faba* Minor were gathered at different stages of development, and the following were detd.: moisture, ash, part extd. by ether; total N, protein N, non-protein N, sol. reducing sugars and saccharose, sol. polysaccharides, starch and hemicellulose. In ripe seeds, the nitrogenous substances were fractionated and the following were isolated: adenine, as the picrate, xanthine, hypoxanthine, uric acid, cytosine, arginine and betaine. Finally, peptase and amylase were shown to be present in the seeds. W. D. LANGLEY

Influence of light on the absorption of nourishment by young plants. H. WIESS-MANN. *Z. Pflanzenernahr. Düngung* 4B, 153-5 (1925).—The total wt. of the plant and roots and content of K_2O and P_2O_5 were progressively less in plants grown out of doors and inside windows with southern and northern exposures in the order named. A. L. MEHRING

• Acidity and varietal resistance of wheat to *Tilletia tritici*. A. M. HURD-KARRER. *Am. J. Botany* 12, 359-71 (1925).—The wheats found to yield a juice having low titrable acidity are Jones Fife, Hybrid 128, Jenkin, Martin and probably White Winter. Those characterized by high titrability acidity are Hussar, White Odessa, Ridit, Florence, Little Club and probably Banner, Berkeley and Turkey. Sixty citations to literature are given. J. J. SKINNER

The condition of infection in potato wart. F. WEISS. *Am. J. Botany* 12, 413-42 (1925).—The most favorable soil reaction for infection of potatoes with *Synchytrium endobioticum* is from neutral to slightly acid, the range being about p_{H} 3.9-8.5. J. J. SKINNER

A study of the conductive tissue of shoots of the Bartlett pear and the relationship of food movement to dominance of the apical buds. F. E. GARDNER. Calif. Agr. Expt. Sta., *Tech. Paper* 20, 42 pp. (1925).—Starch deposition in shoots of the Bartlett pear begins shortly after the cessation of length growth. Starch is deposited first at the tip of the shoot and then progressively downward toward the base. As growth begins in the spring, it disappears from the tip and then from the lower regions of the shoot successively. The bark is much higher in sugar content than is the wood. The cortical parenchyma is the tissue abounding most in these carbohydrates. Solns. of glucose and of asparagine were forced through excised shoots and were found to pass readily. This fact indicates that the tracheal cross-walls are permeable to these substances, and that so far as permeability of the tissues is concerned there is no objection to the belief that these foods move in the xylem. Ringing of Bartlett pear shoots, by removal of a band of bark from the woody cylinder, interrupts the longitudinal movement of carbohydrates. Tyloses, when present in *Robinia pseudacacia*, effectively block the passage of water and solns. of glucose and asparagine through the tracheal tubes. Observations on tylosis formations indicate that the conduction of foods in this species is limited to the phloem or to the very outermost xylem. The inner xylem is completely obstructed by tyloses. Both the new and the old tracheal tubes of normal excised pear branches allowed water and solns. of glucose and asparagine to pass through under pressure. The results indicate that there is little reason to believe that the outer and inner xylem act differentially in the conduction of foods and water, i. e., that the outer xylem conducts only foods, while the whole cross-section is used for water transport. This study of the conductive tissues in shoots of the Bartlett pear seems to

indicate that, in this plant, the phloem is the tissue largely concerned in the longitudinal movement of foods and that there is a direct relationship of food movement to dominance of the apical buds, in that the nutritive condition from the carbohydrate-N standpoint is presumably involved.

J. J. SKINNER

The influence of soluble aluminium salts on the growth of wheat seedlings in Shive's R_2C_3 solution. R. M. BARNETTE. New Jersey Agr. Expt. Sta., *Ann. Rept.* 1923, 255-8.—Al was toxic to wheat in soln. cultures at concn. of 0.5 mg. per l. of soln. The toxicity is attributed to the Al ion and not to the increase in H-ion concn.

J. J. SKINNER

Mn chlorosis of pineapples (JOHNSON) 15. Rotenone, an active constituent of derris root (TAKEJI) 10.

E—NUTRITION

PHILIP B. HAWK

Physiological measurement of factor A. M. JAVILLIER, P. BAUDE AND MISS S. LÉVY-LAJEUNESSE. *Bull. soc. chim. biol.* 7, 831-41(1925); cf. *C. A.* 19, 2227.—White rats, 35 to 55 g. wt., preferably from the same mother and in any case from mothers who have had identical diets, and themselves fed a uniform diet after weaning, are placed on a diet completely deficient in A. Growth ceases after 19 to 25 days. The diet is continued until there is a 10% loss in wt., which usually requires 5 to 6 days. The substance under test is then fed, preferably separately from the rest of the diet, and in proportion to the wt. of the animal. The unit of factor A is defined as that which, added to the limit dose which merely maintains the animal at const. wt., causes growth to recommence, with continuance for at least 30 days, during which the gain of living matter is about 30% (and the angle of growth 30 degrees where days and g. are given the same linear value).

A. T. CAMERON

The time relationship of the changes which occur in the blood as the result of the injection of insulin in depancreatized animals. I. L. CHAIKOFF, J. J. R. MACLEOD, J. MARKOWITZ AND W. W. SIMPSON. *Trans. Roy. Soc. Can.* 19, Sect. V, 63-9(1925); cf. following abstr.—The % amts. of blood sugar and ketone bodies are decidedly higher in fat depancreatized dogs several days after discontinuing insulin and food than in thin dogs. Of the blood ketone bodies, acetoacetic acid was relatively greater in fat dogs and β -hydroxybutyric acid in thin ones. Fat animals survived the withdrawal of insulin for a much shorter time than thin ones and succumbed to symptoms not unlike those of diabetic coma in man. On giving insulin again the inorg. phosphates and β -hydroxybutyric acid diminished at uniform rates, acetoacetic acid more slowly and fat not at all, within several hrs. After the effect of insulin had passed off the H_3PO_4 rose first.

A. T. CAMERON

Further data on the metabolism of depancreatized dogs kept alive with insulin. I. L. CHAIKOFF, J. J. R. MACLEOD AND J. MARKOWITZ. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, lxxi-lxxii(1925); cf. preceding abstr.—“By daily feeding with raw pancreas (50 g.) along with flesh (200 to 400 g.) and cane sugar (up to 50 g.) and the injection twice daily of about 16 clinical units of insulin, dogs weighing approx. 8 to 10 kg. can be kept in a perfect condition of bodily nutrition. One animal is still living after 15 months on this diet and another after 9 months. . . . Various studies have been made of the chem. changes which occur in the blood and urine following discontinuance of insulin in these animals for several days and also of the changes produced by again giving this hormone. The main results show a remarkable correspondence in the rate at which changes occur in sugar, AcMe bodies and in the H_3PO_4 of the blood. All 3 come down at an equal rate after injecting insulin, but the H_3PO_4 starts to return to the original level more quickly than the other two. No const. changes have been observed in the % of fat in the blood within several hrs. of the injection of insulin. The % amts. of ketone bodies, of sugar and of fat are higher 3 to 5 days after discontinuing insulin in a fat depancreatized dog than in one that is thin.”

I. GREENWALD

The antisterility vitamin fat-soluble E. H. M. EVANS* AND G. O. BURR. *Proc. Natl. Acad. Sci.* 11, 334-41(1925).—When rats are reared on synthetic food mixts. consisting of fat, carbohydrate and protein, together with an appropriate salt mixt. and vitamins A and B they grow well and appear healthy. But depending on the proportions of the dietary constituents and their exact character, they ultimately exhibit complete sterility. Sterility is a dietary deficiency disease for it can be cured or prevented by a change in diet involving the addn. of certain single foods, high in a new food factor, vitamin E (formerly designated by the authors as vitamin X). The sterility disease leads to the ultimate destruction of the germ cell in the male. In the female the

ovary and ovulation remain unimpaired, but a characteristic disturbance occurs in gestation, the death and resorption of the developing young where E is low or absent. Animals reared on a natural diet contg. E show normal fertility, but when deprived of E lose their fertility after 3 or 4 months. Such sterile animals may be cured by feeding foods contg. E, or by subcutaneous or intraperitoneal injections of concentrates of E prep'd. from wheat germ exts. E is to be found in wheat, corn, oats, certain leaves (lettuce, alfalfa, pea, tea), in the tissues of animals fed on natural foods, and is probably present in most com. oils and hydrogenated oils. The vitamin is fat-sol. and is completely miscible with most org. solvents. It is insol. in H_2O . E is stable to heat, light, air and many chem. reactions. Distn. of wheat germ oil, rich in E, *in vacuo* at 230° changes neither the potency nor soly. of E. At normal temps. E is stable to sat'd. alc. HCl, 20% HCl and concd. H_2SO_4 . It is stable to boiling 20% alc. KOH and is non-saponifiable. An outline for the prepn. of highly potent exts. of E from wheat germ is given.

W. F. GOEBEL

Invariable occurrence of male sterility with dietaries lacking fat-soluble vitamin E. H. M. EVANS. *Proc. Nat. Acad. Sci.* 11, 373-7(1925).—When male rats from mothers reared on diets contg. vitamin E are weaned on the 21st day of life and then reared on a basal pure food ration lacking E they become sterile after the fourth month. Male sterility in rats reared and held on such a basic ration develops broadly in four stages. (1) Normal abundance of sperm in the bouchon vaginale; loss of fertilizing power of the sperm; approximately normal sex responses. (2) Complete loss of sperm from the bouchon vaginale; sterility. (3) Loss of power to form the vaginal plug. (4) Loss of all sex interest. Male sterility can be prevented by feeding from the day of weaning, in addition to the basic ration, foods containing vitamin E.

W. F. GOEBEL

The effect of methods of preparation upon the vitamin content of spinach. LOUISE STANLEY AND HANNAH A. STILLMAN. *J. Home Econ.* 16, 558-65(1924).—Four g. raw fresh spinach was necessary to support normal growth in rats weighing 60-100 g. Cooking spinach at 100° for $1\frac{1}{2}$ hr. does not destroy vitamin in the absence of soda or seasoning and when the liquid portion is retained. Higher temps. and longer periods of cooking reduce the vitamin content. Dried spinach fed in amts. equal to 7 g. fresh raw spinach produced no wt. increase. Expts. indicated that dried spinach contains B but is deficient in A and C.

L. D. ELLIOTT

Material exchange in rice alimentation. II. The nitrogen metabolism in adult and developing white rats kept on rice. A. CLEMENTI. *Arch. fisiol.* 22, 257-78(1924); *Physiol. Abstracts* 10, 97; cf. *C. A.* 11, 3307.—Adult rats kept on rice, no matter whether polished or not, gradually lose in weight and show either a positive or a slightly negative N metabolism. Young rats fed on polished rice cease to grow, have a positive N metabolism, and finally die either without showing any special symptom or after convulsive fits similar to those observed in pigeons. Young rats kept on unpolished rice also cease to grow, but after a longer time from the beginning of the expt., and generally survive or die of intercurrent affections (pneumonia) to which they appear to become particularly liable.

H. G.

Phosphorus in alimentation of healthy subjects and pellagra patients. P. ALBERTONI AND P. TULLIO. *Arch. sci. biol.* (Italy) 6, 310-40(1924); *Physiol. Abstracts* 10, 99.—The P metabolism of healthy subjects and pellagra patients differs according as to whether P is of animal or vegetable origin. Animal foodstuffs contg. P are more useful to the organism than vegetable ones; the former meet org. needs with a smaller quantity of total P than the latter, and only the former contain a sufficient amt. of certain phosphoretted principles which are indispensable to the normal function of the human organism.

H. G.

Artificial preparation of vitamin B. D. GANASSINI. *Boll. soc. med. chir. Pavia* 36, 476-80(1924); *Physiol. Abstracts* 10, 99.—By the hydrolysis of the nucleic acid of beer yeast substances in soln. were obtained which had a stimulating effect on the development of yeast and a curative and preventive influence on the polyneuritis of pigeons fed on polished rice. A microcryst. powder was prep'd. from the soln. which gave a positive Jendrassik reaction and possessed, though in a much high degree, the same physiol. properties as the soln.

H. G.

Catabolism of odd in comparison with even carbon-fatty acids in man. H. LUNDIN. *J. Metabolic Research* 4, 150-76(1923); *Physiol. Abstracts* 9, 465; cf. following abstr.—The ketosis on a high fat diet (177 g. fat + 20 g. carbohydrate) can be quickly removed by replacing 100 g. of natural fat with 100 g. of odd C fatty acid fats, but is replaced by an acidosis due to lactic or pyruvic acids. These disappear if the carbohydrate is increased by 50 g. It is apparent that odd C fatty acids require carbohydrate for their complete metabolism.

H. G.

Clinical observations with odd-carbon-atom fat (intarvin). F. S. MODERN. *J. Metabolic Research* 4, 177-89(1923); *Physiol. Abstracts* 9, 465; cf. preceding abstr.—Intarvin creates essentially the same insulin requirement as natural fat, and is, therefore, not extensively converted into carbohydrate. It is of no value in diabetic treatment.

H. G.
Nutrition and cell functions. E. ABDERHALDEN. *Med. Klin.* 20, 1697(1924); *Physiol. Abstracts* 10, 97.—Wide differences in reaction to insulin and adrenaline occur in rabbits fed with oats or green fodder. Oats with their prevalence of acid valencies lower the reaction to insulin and increase the adrenaline reaction. Rats fed without carbohydrates behave in a similar way. The rabbits fed on green fodder (alk. valencies) reacted in the opposite way. Animals fed with oats produce 4 or 5 times more hippuric acid from benzoic acid and glycocholl than green fodder animals.

H. G.
Some application of the new cysteine reaction. M. X. SULLIVAN. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xi(1925); cf. *C. A.* 19, 2834.—"In strong polyneuritis on a rice diet, the tissues of pigeons have little if any cysteine, but do contain cystine; while on a rice diet plus vitamin, the tissues of the pigeons contain cysteine as well as cystine."

I. GREENWALD
The influence of diet on fat production in the animal body. Wm. E. ANDERSON. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xli-xlvii(1925); cf. *C. A.* 19, 1720.—A high protein diet produces a "hard" fat, like that found after carbohydrate feeding.

I. GREENWALD
Acetylation as a detoxicating reaction. J. B. MUENZEN, L. R. CERECEDO AND C. P. SHERWIN. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xvi-xvii(1925).—"In general we found that the dog will acetylate an aliphatic amino compd. or the side chain of an aromatic compd., while the human being and the rabbit may fail to acetylate these compds. entirely, but are able to acetylate the amino groups attached directly to the benzene ring. Acetylation in the body is apparently limited to amino compds. . . The human organism is able to acetylate both *p*- and *m*-aminobenzoic acids. . . The influence of diet, etc., on acetylation was studied. Acetylations in the human being as well as in the rabbit are very likely confined to the liver. The possibility of using this reaction as a functional liver test was investigated and yielded promising results."

I. G.
The nature of urinary glucose. W. C. AUSTIN AND T. E. BOYD. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xxii-xxiii(1925).—Polarimetric detns. of the glucose content of the urines of fasting, phlorrhizinized dogs gave const. values over long periods of time and these values agreed with those obtained by the Shaffer-Hartman method. Injections of insulin did not alter the ratio between rotation and Cu reduction.

I. GREENWALD
Adequacy of pigeons and rats for vitamin B studies. A. D. EMMETT AND GAIL E. PEACOCK. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xxiii(1925).—"The pigeon, judged by the wt. curve, as well as by the prevention of polyneuritis, can be used to det. quant. vitamin B, with as fair a degree of accuracy as the rat. Whether the basal diet of the pigeon is polished rice, or one high or low in carbohydrates, or the same as the regular vitamin B-deficient ration generally given to rats, does not seem to alter the conditions to any essential degree. When given a basal diet of polished rice supplemented with 0.00015 g. of one of our concentrates, pigeons show a decided gain in wt., whereas, when the dose is reduced to 0.0001 g., the birds are kept in equil., maintaining their wt. The vitamin B requirements of mature pigeons always run 2 or 3 times higher than the normal growth requirements of young rats."

I. GREENWALD
The influence of milk rations high and low in fat on the sex glands of male albino rats, with special reference to substance X. H. A. MATTELL AND M. M. CLAYTON. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xxvii-xxviii(1925).—"In rats on a milk diet low in fat, the proportion having normal testes, though larger than in those on a similar diet rich in fat, was still only 38%, as compared with 92% in the controls. "Of 15 animals transferred from inadequate to adequate diet after 130 days of age, only one failed to show degeneration. Adequate food for as long as 200 days thereafter failed to restore fertility. Conversely, of 10 animals transferred from adequate to inadequate rations before 90 days of age, only one escaped degeneration. Of 14 so transferred after 90 days of age only three suffered degeneration. . . Of the unsaponifiable constituents of wheat-embryo oil those transformable into cholesterol by the animal probably do not include vitamin X, for the blood cholesterol of animals showing degeneration tends to be higher than that of normal animals."

I. GREENWALD
Mineral metabolism of adult man. G. W. CLARK. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xxviii-xxix(1925).—A statement that metabolism expts. had been made upon 4 men, with 5 different diets. The food and excreta were analyzed for Ca,

min-B-free diet, as suggested by Drummond and Watson (*C. A.* 16, 3934), but without the addn. of lemon juice. BENJAMIN HARROW

The problem of protein substitution by ammonium salts and amino substances for animal nutrition. K. SCHARRER AND A. STROBEL. *Z. angew. Chem.* 38, 601-9 (1925).—A crit. review with bibliography. S. does not consider the problem settled.

C. G. KING

Studies of the vitamin potency of cod-liver oils. XVI. The vitamin A potency of shad body oil. A. D. HOLMES. *Boston Med. Surg. J.* 192, 300-2(1925); cf. *C. A.* 19, 2365.—Shad body oil is studied as the representative of the fat contained in the muscles of the so-called "fat fishes." This fat serves the same physiol. purpose in these fishes as does the fat in the livers of cod and other fish of this class. However, as compared with cod-liver oil, shad body oil does not contain vitamin A. J. H. L.

The relation between night blindness and malnutrition. Influence of deficiency of fat-soluble A vitamin in the diet on the visual purple in the eyes of rats. L. S. FRIDERICIA AND EILER HOLM. *Am. J. Physiol.* 73, 63-78(1925).—When the visual purple of the retinae has been completely bleached by exposure of the rats to light, the regeneration of the purple is delayed in rats starved for vitamin A as compared with control rats receiving an adequate diet. If night blindness depends on a defect in the function of the visual purple, then both vitamin A deficiency and exposure to intense light may be factors in its production. J. F. LYMAN

Demonstration of hemeralopia in rats nourished on food devoid of fat-soluble A vitamin. E. HOLM. *Am. J. Physiol.* 73, 79-84(1925).—A method for testing visual power in rats is described. A condition similar to night blindness in man was demonstrated in rats nourished on food devoid of vitamin A. After 2 or 3 days feeding with food contg. vitamin A night blindness disappeared in affected animals. Hemeralopia does not develop through lack of vitamin A alone. It is necessary also that the individuals be much exposed to the light. J. F. LYMAN

The physiology of vitamins. III. Quantitative aspects of the relations between vitamin B and appetite in the dog. G. R. COWGILL, H. J. DEUEL, JR. AND A. H. SMITH. *Am. J. Physiol.* 73, 106-26(1925).—Two methods for detg. the vitamin B requirement of dogs were used: (1) Dogs that had lost appetite, and in some cases contracted symptoms of polyneuritis also, were given single large doses of concd. vitamin B prepn. (2) Small continued daily doses of vitamin B concentrates were administered at various levels to det. the min. necessary for maintenance of appetite. The chief disadvantage of the last method is the long time required. Normal appetite for two months is not long enough to give complete proof that the dog's requirement for vitamin B is fully met. The daily requirement appears to be definitely related to size (body wt.) when a standardized ration is fed. The min. requirement is met under the exceptional conditions here described by 40 mg. yeast vitamin concentrate (Harris) or 600 mg. wheat embryo vitamin (Vitavose) per kg. per day. Beef ext., which is known to stimulate the flow of gastric juice, is without effect in restoring appetite when dogs refuse food after continued feeding on a vitamin-B-deficient diet. The effect of vitamin B on the appetite, therefore, is not through stimulation of the flow of gastric fluid. J. F. LYMAN

The reduced sensitivity to insulin of rats and mice fed on a carbohydrate-free excess-fat diet. H. W. BAINBRIDGE. *J. Physiol.* 60, 293-300(1925).—A diet from which carbohydrate is absent and which contains an excess of fat reduces the sensitivity of animals to insulin. J. F. LYMAN

The metabolism of carbohydrates. The mutarotation of β -glucose. CHRISTEN LUNDGAARD AND S. A. HOLBOELL. *Compt. rend. soc. biol.* 92, 115-6(1925).—The glucose formed when insulin or muscle tissue is added to α , β -glucose is not identical with β -glucose but is a substance of unknown nature. This so-called neo-glucose is produced in small amts. Comparative studies of the diffusion of glucose contained in blood and in pure glucose solutions. *Ibid* 116-8.—The difference in diffusibility of glucose present in blood and in pure solns. is entirely quant. The behavior of the glucose under these conditions is shown in the equation $q = M / \{ [(K_I + K_{II})/2] \div [(k_1 + k_2)/2] \}$, where q is the coeff. of diffusion, M the quantity of glucose traversing the membrane in 15 min., K_I and K_{II} are the concns. of the inside liquid before and after the 15 min., k_1 and k_2 the corresponding concns. of the outside liquid. For pure glucose solns. q was 0.215, while for bloods under different conditions it was 0.087. The expts. showed that the diffusibility of the glucose is the same in normal as in diabetic individuals. It is also concluded that no appreciable quantity of glucose is combined with the colloids of the blood but that the blood sugar is in the free state both in normal and diabetic persons. S. MORGULIS

Experimental fluorine cachexia: the effects of chronic ingestion of small doses

of sodium fluosilicate. H. CRISTIANI AND R. GAUTIER. *Compt. rend. soc. biol.* 92, 946-8(1925). S. MORGULIS

Diet composition and vitamin B. CASIMIR FUNK, J. A. COLLAZO AND JOSEPH KACZMAREK. *Compt. rend. soc. biol.* 92, 997-8(1925).—Expts. on pigeons show that protein metabolism requires less vitamin B than carbohydrate metabolism. With the same amt. of vitamin B a greater quantity of protein than of starch can be utilized. S. MORGULIS

Complement deviation reaction in human beriberi. P. NOËL BERTRAND. *Compt. rend. soc. biol.* 92, 1038-40(1925). S. MORGULIS

Avitaminosis, disturbances in growth and rickets. BANU, NEGRESKO AND HERESCO. *Compt. rend. soc. biol.* 92, 1166-8(1925).—Thoroughly sterilized diets produce a retardation of growth and influence the general nutritive state of young dogs. Heat or darkness produce the same effects in dogs on a sterilized diet but the onset is quicker. No evidence is found of lesions of the rickets type. S. MORGULIS

Effect of alkaline fluorides on animals. H. CRISTIANI AND R. GAUTIER. *Compt. rend. soc. biol.* 92, 1276-7(1925).—Guinea pigs kept in cages the straw of which is sprinkled with NaF or NH_4F show signs of cachexia and usually die in about 8 weeks. S. MORGULIS

Seasonal variations in some of the mineral components of milk. A. BLANCHETIÈRE. *Compt. rend. soc. biol.* 92, 1295-7(1925).—In the winter the alk. elements Na and K, diminish, while the alk. earth, Ca, increases. The av. data obtained in a series of analyses extending over many months are as follows: Na 44.8, 32.5; K 100.6, 79.5 and Ca 111.2, 135.5 mg. per 100 cc. milk in the summer and winter, resp. S. MORGULIS

Studies of the tissue enzymes of pigeons on a normal and a vitamin-deficient diet. ST. DRAGANESCU AND ADELA LISSIEVICI DRAGANESCU. *Compt. rend. soc. biol.* 92, 1470-2(1925); cf. C. A. 19, 3305.—There is no difference in the amylase and trypsin of the pancreas of normally fed pigeons and those on a diet lacking in vitamin. The catalase activity of the liver and the reductase activity of the tissues are somewhat decreased especially in pigeons suffering from chronic avitaminosis. S. MORGULIS

Synthesis of vitamins by yeast. ROSE ZAJDEL AND CASIMIR FUNK. *Compt. rend. soc. biol.* 92, 1527-8(1925).—Expts. with 6 species of yeasts cultivated in pure sucrose solns. show that the presence of vitamin D is indispensable for the growth of these organisms. Their reproduction diminishes as the supply of vitamin D decreases, and ceases entirely in a highly purified medium. However, in 6 other species of yeasts it was noted that they may grow in the absence of vitamin D. It is suggested that certain yeasts can synthesize vitamin D. S. MORGULIS

The persistence of the antiscorbutic power of orange sirup. M. S. VAGLIANO. *Compt. rend. soc. biol.* 93, 602-4(1925).—Four parts of orange juice, 2 parts of sugar and 1 part H_2O heated for 1-2 hrs. to 115-120° give a sirup which retains its antiscorbutic power even after 6 month's preservation. S. MORGULIS

The influence of lemon juice on tissue respiration of normal and scorbutic guinea pigs. AXEL HÖJER. *Skand. Arch. Physiol.* 46, 241-56(1925).—Scorbutic organs show no marked diminution in the intensity of respiration by the Thunberg methylene blue method. Healthy organs (liver, muscles, spleen, brain, kidney) have a greater respiratory rate upon the addition of fresh raw lemon juice, which is also found in the scorbutic organs though to a larger degree. This effect of the fresh lemon juice remains even at a dilm. of the juice of more than 10^{-6} . The same juice, inactivated through aeration for 1 hr. at 100° or through autoclaving 4 hrs. at 120°, has a retarding influence on tissue respiration. S. MORGULIS

Experimental and clinical researches on cholesterol and its metabolism. HENRI COLOMBIÈS. M. D. Thesis, Toulouse 1924, *Bull. soc. hyg. aliment.* 13, 416(1925).—Cholesterol is assimilated in the liver and lungs, where it is broken down or eliminated. During digestion, the spleen and the intestinal mucous membrane seem to play an important part in cholesterolemia. The kidney allows the cholesterol content of the blood to increase, but does not eliminate this substance. Ablation of the spleen, the suprarenals, the thyroid or the parathyroids causes an increase in the cholesterol content of the blood when the hepatic cell is not broken down. The same is true of all diseases in which the equil. of the hormones is disturbed, more particularly in diabetes, Bright's disease and uricemia. In hepatitis, on the other hand, the cholesterol content decreases. A. PAPINEAU-COUTURE

A new case of physiological mutation in mice. GABRIEL BERTRAND AND HIROSI NAKAMURA. • *Bull. soc. hyg. aliment.* 13, 381-4(1925); cf. B. and Benzon, C. A. 18,

§409.—In the course of expts. on the physiological importance of Fe one animal showed no apparent disturbance till the 59th day, when it began to show signs of xerophthalmia, and died on the 65th day without other general symptoms than progressive weakening. B. and N. showed this could not be due to accidental introduction of vitamins by a stray fly that might have been captured by the mouse, and no cause for the delayed effect could be found. A. PAPINEAU-COUTURE

Fat metabolism in avitaminosis. II. The total fat, neutral fat, cholesterol and cholesterol ester content of the blood of normal, starved, avitaminosis and phosphorus-poisoned rats. KAZUO ASADA. *Biochem. Z.* **142**, 44–52 (1923); cf. *C. A.* **18**, 1521.—The blood fat in P poisoning plus avitaminosis (70 days) > simple avitaminosis (70 days) > normal feeding = P poisoning on a normal diet > P poisoning in starvation > simple starvation. In advanced avitaminosis (111 days) when blood fat is almost as low as normal, P may cause a still lower blood fat. In general, cholesterol and cholesterol esters parallel the total fat content of the blood. "The results point to a disturbance in the power of the body cells to take up fat in avitaminosis." **III.** The fat and cholesterol content of the liver after phosphorus poisoning in normal, starving and avitaminosis rats. *Ibid* 165–80.—The total fat content of the liver is decreased after 6–7 weeks avitaminosis to the level reached after 4–5 days simple starvation; in the final stages it is increased to about the normal value. The increased liver fat is accompanied by increased blood fat. In avitaminosis, liver cholesterol decreased progressively; in simple starvation it increased. After P poisoning the following results were obtained: Total fat and cholesterol decreased in the starved animals; avitaminosis animals and animals on a normal diet showed increased liver fat and cholesterol. The H₂O content of the liver in avitaminosis (6 to 7 weeks) was increased about 4%; later (12–13 weeks) it decreased about 2%. GEORGE ERIC SIMPSON

Parasympathetic stimulating substances in vitamin extracts. SEIICHI MORI. *Arch. expll. Path. Pharmacol.* **106**, 320–6 (1925).—The vitamin prepn. used (orypanum liquidum) loses its antineuritic properties when it is heated to 130–175° but its property of stimulating the parasympathetic remains unimpaired, it still being effective in stimulating the salivary secretion and in paralyzing the action of the frog heart. The 2 attributes of the prepn. are thus distinct. G. H. S.

Effect of hunger upon adrenaline secretion and upon the adrenaline content of the adrenal glands. SCHIGESCHI OGAWA. *Arch. expll. Path. Pharmacol.* **107**, 171–79 (1925).—From the beginning of a hunger period the secretion of adrenal incineases while the adrenaline content of the glands does not show a comparable increase, so that after periods of starvation of 8–18 days the secretion becomes diminished and the adrenaline content of the glands reduced to $\frac{1}{3}$. G. H. S.

Colloid biological studies on surface activity and vitamin action. I. The vitaminoid condition. F.-V. v. HAHN. *Arch. ges. Physiol. (Pflüger's)* **208**, 732–44 (1925).—A statement introductory to the following paper. The literature is reviewed with the conclusion that as yet no chemically defined substance has been shown to function as a vitamin. All substances known to be vitamin active are characterized by the fact that they possess a surface activity. **II.** Surface activity and the vitamin content of foodstuffs. *Ibid* 745–60. Detns. of surface activity and of the vitamin content of a large no. of foodstuffs show that there is an almost complete parallelism between the 2 factors. When the foods are grouped according to their vitamin content—as none, slight, moderate, and high—it is found that the first group falls within the range of 0 to 1.5 (expressing the surface activity), the second group within 1.5 to 10.5; the third within 10.5 to 18; and the group of high vitamin content within the range of 18 to 27. (There are exceptions to the last 2 groups.) G. H. S.

F—PHYSIOLOGY

ANDREW HUNTER

The importance of the vegetative nervous system in regard to the carbohydrate metabolism. G. C. BOLLEN. *Nederland. Tijdschr. Geneeskunde* **69**, I, 2521–32 (1925).—According to Falta and others, diabetes mellitus is to be regarded as being due to an atonicity of the parasympathetic nervous system. The metabolism is generally accelerated by the sympathetic system, and retarded by the parasympathetic system. Insulin, being antagonistic to adrenaline, should then be classified as a vagus stimulant. B. sought to det. whether other well-known vagus stimulant drugs (*pilocarpine* and *choline*) exert any diminishing action on blood sugar, but found it impossible to trace any action of this kind. The test expts. were performed on a normal human, who had received 50 g. of glucose intravenously. R. BRUTNER

The connection between the formation of urobilin and the decomposition of the blood. A. LICHTENSTEIN. *Nederland. Tijdschr. Geneeskunde* 69, I, 2508-14, 2648-59 (1925).—In the spleen, in the liver and in the bone marrow, a const. fraction of the blood hemoglobin is decompd. into hematin, which in the liver is transformed into bilirubin. Through bacterial action, this is changed into urobilin which is excreted chiefly in the feces, partly also in the urine. According to Terwen's method (C. A. 19, 3501), the amt. of urobilin can, now, be detd. accurately. In a normal human it amounts to an av. of 0.2 g. per day. From this value, as well as from the total quantity of blood in the body, its hematin content and the mol. weights of hematin, bilirubin and urobilin, L. calculates that it takes 110 to 140 days for a normal human to decompose his entire blood; this value is very much higher than the one assumed so far: 30-40 days, (Quincke) but, as L. believes, more trustworthy. In blood-wasting diseases this period is higher than normal as manifested by the increased urobilin secretion and other clinical findings. L. defines as the *index of blood decompn.*: the time within which a patient consumes his blood as compared with that of a normal. Following a description of some clinical cases of hemolytic icterus and of pernicious anemia, L. shows that the above index increases with the decrease of red blood cells, the hemoglobin content, the color index and other clinical findings.

R. BEUTNER

A contribution to the clearing up of the structure of blood serum. HANS HANPOVSKY. *Kolloid-Z., Special No.*, Apr. 1, 1925, 292-7.—By detg. viscosity, η , soly. in several solvents, and other phys. properties the compn. of serum can be closely calcd. Hundreds of samples of serum from cattle have been analyzed and the results reported. The serum of normal animals differs from diseased animals in η , viscosity or pptn. from solvents, because its compn. is different. A quant. study of the changes in the protein fractions of the serum and the changes in the secondary particles in serum of diseased cattle would aid in diagnosis of disease. It is believed that alkaloids affect the viscosity of serum while As derivs. changed the globulin.

F. E. BROWN

The permeability of enamel. A. LIVINGSTON. *Proc. Roy. Soc. Med.* 18, Sect. Odontol. 27-33(1925).—Expts. performed under conditions approximating to the habitat of enamel during life indicate that it behaves as a membrane which at least permits diffusion to salts in normal saline soln.

A. T. CAMERON

Circulation of lymph in the dentine. E. W. FISH. *Proc. Roy. Soc. Med.* 18, Sect. Odontol. 35-7(1925).—After subcutaneous injection of trypan blue or of Fe^{+++} salts into cats the dentine of the teeth showed rapid penetration, indicating an active circulation of body fluids in the dentine. Analyses of human dentine for Ca indicate that in early life anabolic processes are being carried on. Partial adrenalectomy in rabbits had no effect on Ca of the teeth, but on account of hypertrophy of the remaining adrenal was not considered as effective.

A. T. CAMERON

The limits of the concentration of hydrogen ions in normal blood. E. J. BIGWOOD. *Bull. soc. chim. biol.* 7, 868-83(1925); cf. C. A. 19, 1594.—Analysis of previous results show that with accurate technic the normal p_{H} is maintained between 7.30 and 7.40. B.'s own results show figures between 7.32 and 7.40. In the same individual the limits appear to be slightly narrower.

A. T. CAMERON

The regulation of blood p_{H} in the normal and pathological state. E. J. BIGWOOD. *Bull. soc. chim. biol.* 7, 884-92(1925); cf. preceding abstr.—Largely a summary of previous work, from which it is concluded that *acidosis* and *alkalosis* belong to 2 distinct categories of modifications of the acid-base equil. of blood. To the first, characterized by a regulating power of the fluid neutrality, which remains normal though sometimes insufficient, is opposed a second category of affections in which this regulating power is momentarily wanting, its absence being shown not only by the absence of parallelism of the curves of fluctuation of CO_2 and the bicarbonates, but further by their divergence or convergence.

A. T. CAMERON

The preparation, physiological properties and method of standardization of a parathyroid hormone. J. B. COLLIP AND E. P. CLARK. *Trans. Roy. Soc. Can.* 19, Sect. V, 25-6(1925); cf. C. A. 19, 2076, 2077, 2250.—The most pure and potent ext. so far obtained was prepd. thus: Boil ox glands (kept frozen in a vacuum bottle during transfer to lab.) in 5% HCl 1 hr., dil. with several vols. hot H_2O , remove fat mech., add 10% NaOH to p_{H} 8, then HCl till flocculation, and filter. Dissolve residue in weak NaOH and repeat. Make the combined filtrates acid to Congo red, and add NaCl to satn. Suspend the ppt. in H_2O , and dissolve by addn. of dil. HCl. Reppt. with NaCl, and dissolve ppt. in dil. alkali, adjust p_{H} to 4.8, and remove the iso-elec. ppt. Redissolve in weak acid and repeat the iso-elec. pptn. Dissolve in weak acid at p_{H} 4, or obtain as powder by suspension in abs. alc. and addn. of equal vol. Et_2O , removal of ppt., washing with dry Et_2O , and drying *in vacuo*. Normal dogs under dietary regula-

tion can be used for standardization, the increase in serum Ca being plotted in a definite time with different doses. The unit is defined as $\frac{1}{100}$ the amt. required to produce a 5 mg. rise in serum Ca in 15 hrs. in a dog of 20 kg. The dry wt. of a unit of the purest material obtained was approx. 0.4 mg. This contained 15.5% N, and traces of Fe and S, but no P and gave a negative Molisch.

A. T. CAMERON

Observations upon the effects produced in normal and parathyroidectomized dogs and herbivorous animals by injections of parathyroid extract. J. J. R. MACLEOD AND N. B. TAYLOR. *Trans. Roy. Soc. Can.* 19, Sect. V, 27-38(1925).—Collip's results with parathyroidectomized and normal dogs are confirmed. In normal dogs the temp. was raised after the first injection, and remained high. Results suggest that fat, either in the diet, or in the fat reserves of the body, may be protective against the action of the ext. Herbivorous animals appear to be resistant to the action of the ext.

A. T. C.

The action of Collip's parathyroid extract on blood and cerebrospinal fluid calcium. A. T. CAMERON AND V. H. K. MOORHOUSE. *Trans. Roy. Soc. Can.* 19, Sect. V, 39-43(1925); cf. *C. A.* 19, 2078, and following abstracts.—Collip's results with parathyroidectomized and normal dogs, and with his standardized ext. are confirmed. In the parathyroidectomized animal serum, plasma and cerebrospinal fluid Ca tend to be restored to normal values, and in the normal animal repeated injection raises all 3, the ratio remaining approx. const.

A. T. CAMERON

The action of parathyroid extracts on guanidine. F. D. WHITE AND A. T. CAMERON. *Trans. Roy. Soc. Can.* 19, Sect. V, 45-52(1925).—Vines' method (*C. A.* 18, 1176) for estn. of activity of parathyroid preps. shows negligible activity when used with Collip's active ext. The inhibiting influence of complex substances such as arginine or nucleic acid derivs. on the pptn. of guanidine picrate appears to be responsible for the results obtained by Vines with animal tissues, so that such results probably bear no relation to the functions of these tissues. Marston's reagent for guanidine estn. (*C. A.* 19, 664, 2217) reacts with nitroguanidine, and galegine, and slightly with arginine, giving with the 2 latter a rose-red color. Parathyroid exts. have little or no effect on guanidine, judged by this test which excludes change into creatine, creatinine, or methylguanidine. Guanidine picrate is much less sol. in picric acid than in H_2O .

A. T. CAMERON

* A note on tetany in thyroid-fed rats and the supposed antagonism between thymus and parathyroid. A. T. CAMERON AND J. CARMICHAEL. *Trans. Roy. Soc. Can.* 19, Sect. V, 53-5(1925).—Thymus feeding does not increase the incidence of tetany in thyroid-fed rats nor hasten its onset. The results do not support Uhlenhuth's hypothesis of an antagonism between thymus and parathyroid (*C. A.* 11, 2930).

A. T. C.

The origin of ammonia excreted by the kidney. ST. J. PRZYLECKI. *Arch. intern. physiol.* 24, 13-26(1924); *Physiol. Abstracts* 10, 102(1925).—Since urease is absent from the glycerol exts. of the kidney in the dog, the bullock and the frog, and since the subcutaneous injection of urea in frogs, even with a simultaneous injection of lactic acid, causes no change in urinary NH_3 , NH_3 cannot originate from urea but must be formed in the deamination of amino acids and the purines.

H. J. DEUEL, JR.

The breakdown of proteins in frogs after extirpation of the liver. I. ST. J. PRZYLECKI. *Arch. intern. physiol.* 24, 27-40(1924); *Physiol. Abstracts* 10, 100(1925).—After hepatectomy in young male frogs the total urinary N excretion diminished but there was no increase in the forms other than urea and NH_3 . The administration of Na_2CO_3 increased the urea N at the expense of the NH_3 N. This indicates that deamination of amino acids and the synthesis of urea in the frog occurs largely in other tissues than the liver. The frogs survived from 4 to 9 days after liver removal.

H. J. DEUEL, JR.

The lipolytic power of the blood serum, shown in vitro and microscopically. D. LAPPONI. *Ann. d'ig.* 34, 801-13(1924); *Physiol. Abstracts* 10, 81.—For the study of the lipolytic power of the blood serum dilns. in physiol. salt solns. of alc. wheat exts. are recommended. Such dilns. can for microscopical purposes be stained by means of weak solns. of acid fuchsin in distd. water. All blood sera are endowed with a lipolytic power, the degree of which may, however, vary considerably. The lipolytic principle is destroyed if the sera are warmed for 30 min. at 68° to 69° in a water bath.

H. G.

Refractometry of sweat. P. ATTENI TEDESCO. *Arch. sci. biol. (Italy)* 6, 298-309(1924); *Physiol. Abstracts* 10, 110.— n of sweat oscillates between 1.33421 and 1.33820. If calcd. after a period of fasting, or after a small meal, or after an abundant ingestion of fluid, it is considerably lower than after a normal meal, particularly if rich in proteins. An increase in atm. moisture shows *per se* a tendency to raise slightly the n of sweat.

All other conditions being unaltered, the index of the first drops of sweat is higher than that of the subsequent ones. H. G.

The metabolism of isolated bones. T. GAYDA. *Arch. fsiol.* 22, 280-314(1924); *Physiol. Abstracts* 10, 109-10.—The perfusion method can be used for the study of gaseous exchanges of isolated bones. The consumption of O_2 , the production of CO_2 , and the respiratory ratio are about the same for various long bones of the dog perfused with Ringer soln. Perfusion with defibrinated blood causes only a slight increase in gaseous exchanges of the same bones. These are more active in the bones from young animals. The quantity of Ca lost by 1 g. of bone in 1 hr. is greater in the bones from young animals than in those from old ones. The contrary is observed as regards P, which is eliminated as Ca phosphate. Ca is eliminated also as bicarbonate or in the shape of salts of org. acids. H. G.

A study of the effects of radium on metabolism. J. ROSENBLUM. *J. Metabolic Research* 4, 75-88(1923); *Physiol. Abstracts* 9, 487.—Intravenous injection of 100 micrograms of Ra in dogs produced an increase in the N, the total S and the neutral S excretion maintained over 3 days. The excretion of creatinine and of uric acid was not affected. Local application of 16 micrograms for 4 days and 70 micrograms for 4 days was studied in a case of carcinoma. There was a N retention of 1.4 g., S of 0.5 g., CaO of 0.27 g., MgO of 0.29 g., and P of 0.8 g. The analytical picture of the urine was normal. H. G.

Inorganic phosphorus in infant blood. A. R. ROSE, E. A. RIESENFELD AND I. HANDLEMAN. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xlii(1925).—Arterial cord blood is richer in inorg. P, by an av. of 4%, than is venous cord blood. Blood drawn from the fontanel is as likely to contain less inorg. P than the cord blood as more, but when the latter is the case the difference ranges from 10 to 75% as against 10 to 30% when the cord blood contains the greater quantity. The vol. % of cells divided by inorg. P in $m\mu$ yields a figure which is fairly const. for the individual and varied in all from 11.5 to 15, av. 13. I. GREENWALD

Cyclic variations in the composition of fasting bloods in women. RUTH OKBY. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xxxiii-xxxv(1925).—The subjects were 25 normal women students. From a total of 280 detns. by Benedict's direct method, extending over 40 menstrual cycles, it appears that the concn. of uric acid in the blood rises just before or at the onset of menstruation, to about 106% of the av. for the intermenstrual period. This is followed, within from 1 to 3 days, by a fall to about 86% of that value. Within 3 to 7 days, there is a rise to a value usually almost as high as that reached before menstruation. Finally, there is usually a fall to the intermenstrual values. The extreme high and low values observed were 127 and 57%, resp., of the intermenstrual levels for the individuals concerned. In approx. half of these blood filtrates, detns. were also made by the Morris-Macleod method. These showed the same type of variation but the curves were not always parallel. On a purine-free diet, the minima were not much lower than when on a mixed diet but the maxima tended to be higher. Non-protein N values usually rose and then fell during menstruation, but these curves were neither so striking nor so uniform as those from the uric acid detns. There was no apparent relation between the menstrual period and the concns. of urea, creatinine and creatine in the blood. The concn. of sugar varied more, with a tendency to high values, just before and during menstruation than at other times. The cholesterol content of the blood fell from 40 to over 100 mg. per 100 cc. during a period from 3 to 10 days before menstruation. After the onset of the flow, there was a rise, usually abrupt at first, then gradual, to just before the next period. A rise in fatty acid content was sometimes observed during or just preceding the fall in cholesterol. Lecithin content showed little or no variation in relation to menstruation. I. GREENWALD

Some observations on the interrelation between the functional levels of the animal body and the external cooling power. E. S. SUNDTSTROEM. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xli(1925).—"Genetically related rats, which in every other respect were treated similarly, were given ample time to adapt themselves to a series of artificially produced climatic environments, which were maintained so as to give a gradient of cooling power; namely, (1) ordinary room temp. and humidity with air in motion (dry Kata 7, wet Kata 19); (2) high temp. and high humidity plus draft from elec. fans (dry Kata 2, wet Kata 9); (3) high temp. and low humidity (dry Kata 0.9, wet Kata 7); (4) high temp. and low humidity, no "breeze" (dry Kata 0.8, wet Kata 4). . . . Decreasing proportionately with a lowered cooling power were: body wt., relative wt. of liver, kidneys, spleen and thyroid, resting respiratory metabolism, food consumption, blood sugar, blood uric acid, total creatinine of blood, nucleotide N of blood, acid-sol. and lipid P, and lecithin: cholesterol ratio. Increasing with the falling cooling

power were: blood urea and to some extent amino acids, Cl, partial blood cholesterol and relative wt. of adrenals, body temp. of females (males preserved body temp. better), and also a number of body indices, which appear to be positively correlated with the skin area. Besides, the coat of the white rats showed in the hot environments a reddish creamy coloration, the depth of which tended to increase along the cooling power gradient." I. GREENWALD

Cholesterol secretion in the urine. I. J. A. GARDNER AND HUGH GAINSBOROUGH. *Biochem. J.* 19, 667-71 (1925).—Cholesterol exists in urines in free and ester forms and also as a compd. which is only hydrolyzable by strong acids. Large increases of cholesterol were noted in cases of parenchymatous nephritis accompanied by hypercholesterolemia. In a highly albuminous urine the cholesterol was almost wholly pptd. with the proteins on boiling with very dil. AcOH. BENJAMIN HARROW

Blood sugar value during exercise. G. C. E. BURGER AND J. C. MARTENS. *Klin. Wochschr.* 3, 1860-1 (1924).—The blood sugar value is not definitely altered by exercise. MILTON HANKE

Muscle hormone in the secretion process of digestive glands. R. KRIMBERG. *Biochem. Z.* 157, 187-200 (1925).—The carnosic fraction from muscle extractives, when injected into dogs, was very toxic, and also increased the rate of secretion of intestinal fluids. A theory of the mechanism of secretion of digestive juices is presented. W. D. LANGLEY

The origin and course of urea diuresis. I. The physical-chemical explanation of urea diuresis. ERWIN BECKER. *Zentr. inn. Med.* 45, 242-9 (1924).—The phys.-chem. action of urea, *i. e.*, the withdrawal of H₂O from the tissues by osmosis, filtration, lowering of the H₂O-binding power of proteins and increased permeability of the kidney filter are only accessory factors and do not completely explain the diuresis produced by urea. II. **The influence of the circulation and the extra-renal factors.** *Ibid* 273-84.—In urea diuresis the extra-renal factors play an important role, though the action on the kidneys is the chief one. The tissues give up large amts. of H₂O, urea and NaCl into the blood. A subcutaneous injection of hypertonic soln. of NaCl produces an increased diuresis under the influence of urea. The renal action of urea and its extra-renal action are correlated. It is possible that the action of urea on the tissues is related to the stimulation of metabolism which results. JULIAN H. LEWIS

Cellular changes in intestinal fat absorption. W. CRAMER AND R. J. LUDFORD. *J. Physiol.* 60, 342-6 (1925).—Histol. evidence is presented that the synthesis of fat which proceeds in the cells of the intestinal epithelium during fat absorption takes place chiefly in the Golgi app. J. F. LYMAN

The coagulation of blood plasma when divested of corpuscles. J. W. PICKERING AND H. S. REEVES. *J. Physiol.* 60, 276-81 (1925).—Bird blood plasma, devoid of all formed elements, clots, but at a much slower rate than when corpuscles are present. When bird plasma is cooled to 0° a ppt. exhibiting the reactions of Nolf's thrombozyme (*C. A.* 16, 2151) is obtained. It contains P and is thermostable at 100° to 120°. J. F. LYMAN

The regulation of renal activity. XI. The rate of phosphate excretion by the kidney. The effect of variation in the concentration of phosphate in the plasma on the rate of phosphate excretion. T. ADDIS, B. A. MEYERS AND LEONA BAYER. *Am. J. Physiol.* 72, 125-42 (1925); cf. *C. A.* 18, 3422.—It is believed that if the conditions could be kept const. the rate of phosphate excretion would vary as the plasma phosphate. J. F. LYMAN

Extra-hepatic bilirubin formation in surviving organs. I. Investigations on surviving spleen. Z. ERNST AND B. SZAPPANYOS. *Biochem. Z.* 157, 16-29 (1925).—II. **Investigations on surviving spleen, kidney, and lungs.** Z. ERNST. *Ibid* 30-8.—III. **Investigations on the surviving spleen of dogs poisoned with phenylhydrazine.** Z. ERNST AND T. FÖRSTER. *Ibid* 39-45.—See *C. A.* 19, 1006. W. D. LANGLEY

The glycolytic capacity of the blood. III. Studies of the relation between glycolysis and the oxygen consumption of the erythrocytes. YOSHIKANE KAWASHIMA. *J. Biochem. (Japan)* 4, 411-28 (1925); cf. *C. A.* 18, 1700.—Horse red blood cells suspended in physiol. soln. show a measurable O consumption within 24 hrs. at 38°. On the addition of a phosphate mixt. both respiration and glycolysis increase markedly, and this is even more pronounced in case of rabbit blood cells. The extent of glycolysis is generally paralleled by the O consumption. When the respiratory function is destroyed (through freezing and thawing) the glycolytic process also stops, but the 2 processes are really distinct functions of the erythrocyte. Red blood cell suspensions are less stable in the absence of sugar and also show a smaller respiration. IV. **Insulin and glycolysis of erythrocytes.** *Ibid* 429-40.—Old erythrocytes do not recover their glycolytic power

under the influence of insulin. The same thing holds for fresh serum. Insulin has no effect on the glucolytic activity of fresh erythrocytes *in vitro*. Erythrocytes obtained several hrs. after a subcutaneous injection of insulin show no change in glucolytic power.

S. MORGULIS

Renal activity of the dog. G. ANTOINE AND F. LIEGEOIS. *Compt. rend. soc. biol.* 93, 64-5(1925).—The ability to conc. urea and to eliminate phenolsulfonephthalein is greater in the dog than in the human kidney.

S. MORGULIS

Influence of light on nitrogen metabolism. GEORGES FONTÈS AND ALEXANDRE YOVANOVITCH. *Compt. rend. soc. biol.* 93, 269-70(1925).—In the absence of illumination there is a marked lowering of the N elimination in the urine.

S. MORGULIS

The probable absence of ammonia in the circulating venous blood. GEORGES FONTÈS AND ALEXANDRE YOVANOVITCH. *Compt. rend. soc. biol.* 93, 271-2(1925).—Only insignificant traces of NH_3N can be detected in venous blood which may be due to spontaneous formation.

S. MORGULIS

Respiratory gases at the end of a voluntary apnea. PÉRIOT AND MOUTTE. *Compt. rend. soc. biol.* 93, 116-8(1925).—The compn. of the respiratory gases at the end of a voluntary apnea is remarkably const., consisting of 5.9% CO_2 and 13.8% O. The duration of the apnea is entirely a matter of general metabolism, varying with the subject's position, state of digestion or muscular exertion. In a series of expts. where apnea was produced under various degrees of muscular activity the duration ranged from 35 to 60 sec., although under all circumstances the air compn. remained almost the same: 55% CO_2 and 11.75% O.

S. MORGULIS

Contribution to the problem of the mechanism of muscle contracture. The degree of tension and shortening in contracture in animals poisoned with bromoacetic acid. ALFRED SCHARTZ. *Compt. rend. soc. biol.* 92, 1396-8(1925).—The av. tension developed in tetanized muscle is 1500 g., but only 300 g. in muscles in the state of contracture due to $\text{CH}_2\text{BrCO}_2\text{H}$ poisoning; this is regarded as evidence that the 2 phenomena are not produced by the same substance acting on the myofibrils.

S. MORGULIS

Acid-base equilibrium of the cerebrospinal fluid of man. R. CESTAN, M. SENDRAIL AND H. LASSALLE. *Compt. rend. soc. biol.* 93, 563-5(1925).—The p_{H} of the cerebrospinal fluid is somewhat lower than that of the blood plasma (7.26 and 7.36, resp.). The same relationship holds also when the p_{H} of the plasma is above 7.40. But when the p_{H} of the plasma is below 7.32 this simple rule no longer holds invariably, and the H-ion concn. of the cerebrospinal fluid may vary in either direction from that of the plasma. The extreme limits of variation of p_{H} are narrower in the case of cerebrospinal fluid than of the plasma.

S. MORGULIS

Variations in the acid-base equilibrium during hyperpnea. R. TARGOWLA, H. MONTASSUT AND R. RAFFLIN. *Compt. rend. soc. biol.* 93, 330-1(1925).—The degree of alkalosis developed during hyperpnea is the same in epileptics and in normal individuals.

S. MORGULIS

The probability of absence of ammonia in the circulating arterial blood. G. FONTÈS AND A. YOVANOVITCH. *Compt. rend. soc. biol.* 92, 1406-8(1925).—By a method of distn. in which the NH_3 was driven off with a satd. soln. of LiCO_3 at 40-45°, no appreciable amts. of NH_3N were recovered from dog arterial blood even when large amts. (150-200 cc.) were used for the detn. "Inanition which causes acidosis does not increase the quantity of NH_3 in the blood."

S. MORGULIS

The production of alcohol in the animal body. I. The regular increase in the amount of alcohol in eggs during incubation. MORIE AOKI. *J. Biochem.* (Japan) 5, 71-86(1925).—Freshly laid eggs contain about 0.000744 vol. % of alc. The amt. of alc. in fertilized eggs increases slowly with the progress of incubation, reaching 0.003054 vol. % on the 22nd day. The amt. of alc. in the living eggs at room temp. increases more slowly than in the incubator. In dead eggs the alc. does not increase to the same extent nor as regularly as in the developing egg. The normal blood of fowls contains 0.002794 vol. % of alc.; the liver contains 0.003952 vol. %. The alc. in the blood and tissues is regarded as a normal product of cell metabolism.

S. MORGULIS

Changes in ionic concentration of bile and pancreatic juice during the secretion of acid in the gastric juice. P. CARNOT AND Z. GRUZEWSKA. *Compt. rend. soc. biol.* 93, 240-2(1925).—Gastric secretion following histamine injections is accompanied by a marked rise in alkyl. of bile. The reaction of the pancreatic juice at the same time remains practically unaltered.

S. MORGULIS

Blood changes during voluntary hyperpnea. R. TARGOWLA, M. MONTASSUT AND M. KRIVY. *Compt. rend. soc. biol.* 93, 417-9(1925).—During hyperpnea there is no change in the cellular compn. of the blood and this is likewise true for epileptics without convulsions.

S. MORGULIS

* Effect of slight warming of brief duration on the respiratory exchange. The minimum work of thermoregulation in air. DELCOURT-BERNARD AND ANDRÉ MAYER. *Compt. rend. soc. biol.* 92, 1364-6(1925).—A rise of temp. just above 40° of the air surrounding the subject for a short time has no immediate effect upon the metabolic rate.

S. MORGULIS

Influence of water imbibition on glucemia. A. SABATOWSKI AND J. GOERTZ. *Compt. rend. soc. biol.* 93, 662(1925).—Intravenous injections of isotonic NaCl soln. lead to an increase in blood sugar (about 30%); the same result is obtained from the introduction of the soln. into the stomach, though not in the same degree. The blood-sugar curve is not accompanied by any alterations either in the number of erythrocytes, in the total protein or non-protein N of the blood.

S. MORGULIS

The importance of the suprarenal bodies in the arterial hypertension following stimulation of the peripheral end of the cut vagus nerve. B. GUTOWSKI. *Compt. rend. soc. biol.* 92, 1000-3(1925).—The first phase of hypertension depends principally on the increase of the quantity of blood forced by the heart into the arterial system after its inhibition. But the second phase in the hypertension depends upon the intactness of the splanchnic nerves and of the adrenal glands.

S. MORGULIS

Effects of the injection of extracts of the follicular fluid into pubescent females. L. BROUHA AND H. SIMONNET. *Compt. rend. soc. biol.* 93, 557-8(1925).—Injection of follicular fluid exts. into pubescent females lengthens the oestrous cycle without altering the periodicity. It has no effect on the progress of gestation. In the doses used it did not affect the mammary glands.

S. MORGULIS

The effect of bleeding on milk secretion. CH. PORCHER AND A. TAPERNOUX. *Compt. rend. soc. biol.* 92, 1521-3(1925).—The secretion and compn. of milk of the cow were compared before and after bleeding. The av. butter fat content was unaffected by the operation.

S. MORGULIS

The probable role played by sodium chloride in the ionic exchange between blood and tissues. W. MESTREZAT AND Y. GARREAU. *Compt. rend. soc. biol.* 92, 1439-40(1925).—The presence of NaCl (0.01-0.25 *N*) in the medium against which salts with the anions (I, NO₃, SO₄, HPO₄, Fe(CN)₆) were dialyzed through various membranes noticeably increases the rate of diffusion of the anions, the degree of augmentation depending upon the nature of the membrane. The rapidity of the diffusion varies inversely with the valence of the anion, and the optimum concn. of the NaCl in the outside medium is smaller the higher the valence of the diffusing ion. On the av. 0.14 *N* is the optimum for univalent; 0.08 *N* for bivalent; 0.05 *N* for trivalent; 0.01 *N* for quadrivalent ions.

S. MORGULIS

Lipoid composition of the blood in relation to the resistance of the cells. A. GRIGAUT, M. DEBRAY AND W. E. FURSTNER. *Compt. rend. soc. biol.* 92, 935-7(1925).—The resistance of the red cells increases with the amt. of cholesterol present in the blood of different species (mammals).

S. MORGULIS

Ammonia and acidity of normal urines. R. RAFFLIN. *Compt. rend. soc. biol.* 92, 1361-3(1925).—The NH₃ and *p_H* of normal urine vary inversely but this is not invariably the case so that the product NH₃N × *p_H* is not const.

S. MORGULIS

Does the follicular phase affect the hypertrophy of the suprarenal capsule? J. WATRIN. *Compt. rend. soc. biol.* 92, 1451-2(1925).—In the rabbit and guinea pig the suprarenal capsule does not react to the phases of ovulation.

S. MORGULIS

Increased sensitivity to insulin following the ablation of the suprarenal capsules. L. HALLION AND RENÉ GAYET. *Compt. rend. soc. biol.* 92, 945-6(1925).—The double ablation of the suprarenal capsules increases markedly the sensitivity of dogs to insulin injections. The operation also produces a different blood response to insulin, there being a rapid fall in *p_H* and in alk. reserve, which is not observed after the operation not followed by insulin treatment.

S. MORGULIS

Loss of heat and basal metabolism. J. GIAJA. *Compt. rend. soc. biol.* 93, 646-8(1925).—The basal metabolism of different though related animals is detd. by their ability to lose heat from their surface. Hence the differences persist even when the basal metabolism is measured under the most favorable thermal conditions.

S. MORGULIS

* The influence of the nervous system on the metabolism of cholesterol. Contribution to the study of the origin of lipoids in the animal organism. A. RÉMOND, H. COLOMBIÈS AND J. BERNARDEIG. *Compt. rend. soc. biol.* 92, 1503-4(1925).—A comparison of the blood cholesterol from the femoral vein of a normal and paralyzed limb shows a higher level in the former. This is thought to indicate that the active muscle produces more lipid material than the inactive muscle.

S. MORGULIS

The autonomic rhythm of the turtle heart, as influenced by various conditions.

H. P. CHU AND TORALD SOLLMANN. *J. Biochem. (Japan)* 5, 87-97(1925).—An increase in temp. shortens the dormant period, quickens the rhythm and shortens the endurance. The higher temp. also promotes the appearance of the detrimental effects of other unfavorable conditions. Aeration of the soln. shortens the dormancy, gives greater regularity to the curves and prolongs the endurance. O deficiency acts in an opposite direction. At moderately high temp. the ventricular muscle of the turtle often fails to initiate contractions in non-aerated isotonic NaCl. The addition of CaCl_2 in concn. equiv. to that of the plasma (0.025%) to the isotonic NaCl shortens the dormant period, quickens the rhythm, and prolongs the endurance and the work done by the heart muscle. The plasma concn. of KCl (0.03%) generally renders the ventricle non-rhythmic. With 0.015% KCl the dormant period is prolonged, the rate becomes slower and fails to respond to the quickening effect of high temp., but the endurance is not materially altered.

S. MORGULIS

Lactic acid in the blood of the vessels of the liver and muscles. J. A. COLLAZO. *Compt. rend. soc. biol.* 93, 407-9(1925).—Blood coming from the muscle, liver or from the general venous circulation contains more lactic acid than the arteries, which is just the opposite of the behavior of the blood sugar. When insulin is injected into the portal vein the blood coming from the liver shows a very marked hypoglycemia accompanied by a rise in the lactic acid content. A similar condition was observed following insulin in the venous and arterial blood of the femoral muscles, and while the consumption of glucose diminished from 20 mg. to 0, the lactic acid gradually increased from 6 to 11 mg. when the blood sugar, however, commenced to rise (2nd phase) and the glucose consumption of the muscle even exceeded the normal (25 mg.) the lactic acid dropped back to only 2 mg. It is suggested that when the blood sugar falls below a certain level in the arteries the consumption of matter is arrested.

S. MORGULIS

Simultaneous experimental modification of the structure of the pancreatic islands and of the glucemia in frogs. A. SCHWARTZ AND M. ARON. *Compt. rend. soc. biol.* 92, 977-9(1925).—Sectioning the duodenal mesentery in frogs frequently causes an acute degeneration of the pancreas (both of the external and internal secretion part) and such animals show a tendency to hyperglucemia.

S. MORGULIS

Seasonal variations in the relationship between the structure of the endocrine pancreatic islands and the glycogen content of the frog liver; their significance. M. ARON AND A. SCHWARTZ. *Compt. rend. soc. biol.* 92, 979-81(1925).—The development of the endocrine pancreatic islands is not governed by an inevitable seasonal cycle but is responsive to a variety of factors which are experimentally modifiable. The islands of the early summer type certainly promote the glycogenic function of the liver and the utilization of sugar. When the demands upon the carbohydrate reserves are slight, as during hibernation, a few islands of this type suffice to maintain a high per cent of glycogen in the liver.

S. MORGULIS

Variations in the iron reserves of the new-born of different species. GEORGES FONTÈS AND LUCIEN THIVOLLE. *Compt. rend. soc. biol.* 93, 683-5(1925).—The Fe content per cc. blood is approx. the same in different species (0.48-0.50 mg.) but decreases during lactation: 30% in the dog; 50% in the cat, and 20% in the rabbit. The total Fe content of the blood, however, is doubled in the dog, quadrupled in the rabbit and in the cat it remains nearly unchanged. Both the rabbit and cat new-born contain a relatively large Fe reserve.

S. MORGULIS

The minimum daily elimination of iron in the adult dog. GEORGES FONTÈS AND LUCIEN THIVOLLE. *Compt. rend. soc. biol.* 93, 685-7(1925).—The daily av. excretion of Fe in the feces of the dog is 1.07 mg.

S. MORGULIS

The iron content of serum (not in the form of hemoglobin) and its diminution in the course of experimental anemia. GEORGES FONTÈS AND LUCIEN THIVOLLE. *Compt. rend. soc. biol.* 93, 687-9(1925).—Serum (horse) contains on the av. 2 mg. of Fe per l. which is not in the form of hemoglobin. Spectroscopic examn. shows that the trace of HbO_2 in serum could not account for more than 0.01 mg. per l. The l. of serum thus contains only $1/250$ of the Fe present in a l. of blood as hemoglobin. In anemia caused by repeated bleeding the value of the Fe dissolved in serum diminishes.

S. M.

Determination of the degree of hematuria and hemoglobinuria. GEORGES FONTÈS AND LUCIEN THIVOLLE. *Compt. rend. soc. biol.* 93, 689-90(1925).—Since urine contains merely a trace of Fe (about 0.5 mg. per l.) a detn. of its Fe content is a good measure of hematuria or hemoglobinuria.

S. MORGULIS

Rate of sedimentation of corpuscles is independent of cholesterol content of the blood. M. SALOMON, DEPORTER AND VALTIS. *Compt. rend. soc. biol.* 92, 1410-2(1925).

S. MORGULIS

The uric acid content of blood plasma in normal persons. Relation between the

free and total uric acid. C. M. JONES. *Compt. rend. soc. biol.* **93**, 298-9(1925).—The detns. were made on plasma made incoagulable with hirudin. One portion was subjected to ultrafiltration to obtain the free uric acid, while a second portion was hydrolyzed and the total uric acid content was thus obtained. The results show that the total uric acid content varies from 32 to 49 mg. per l., 70% of which is in the free state.

S. MORGULIS

Respiratory exchange of man during a brief period of mild cooling. DELCOURT-BERNARD AND ANDRÉ MAYER. *Compt. rend. soc. biol.* **92**, 1297-300 (1925).—A reduction of the temp. under the clothes of 2-3° was produced by partially unrobing and maintaining this lower temp. for 20 min. Under these mild exptl. conditions the response of different individuals varies, some showing an increased, and others a decreased, O intake. The CO₂ expired also differs individually but does not seem to vary strictly with the O consumption.

S. MORGULIS

An investigation into the free and combined pepsin in the stomach contents. KAJ KJER. *Acta med. Scand.* **62**, 131-41(1925).—In cases where the Congo red value is 0 and the phenolphthalein value low (achylia) there is found a very small amt. of free pepsin, but the total amt. in a number of cases, especially those with a high phenolphthalein value, is not inconsiderable. The total amt. of pepsin rises to some extent with the acid concn.

S. MORGULIS

Studies of the partition of blood glucose between corpuscles and blood plasma. Contributions to the carbohydrate metabolism. E. FOCK AND S. A. HOLBOELL. *Compt. rend. soc. biol.* **92**, 1315-7(1925).—Blood is collected by venopuncture into a paraffined tube (3 cc.) and the glucose is detd. in the blood and plasma by the method of Hagerdorn and Norman-Jensen. The cell vol. was estd. by centrifuging. From these data the ratio G/P, i. e., glucose in cells over glucose in plasma, has been found. For both normal and diabetic persons in the fasting state this ratio was found to be approx 0.75. Following the ingestion of 100 g. glucose this rises, about 1 hr. after the ingestion, as was also observed to occur after insulin administration in diabetics. This is interpreted to mean that the plasma glucose is absorbed into the tissues in the capillary circulation. The occurrence of high ratios in diabetics without insulin treatment, who are unable to utilize glucose, is taken to mean that this low plasma glucose is due to an elimination in the renal capillaries.

S. MORGULIS

Oxygen content of methemoglobin. MAURICE NICLOUX AND JEAN ROCHE. *Compt. rend.* **180**, 1968-70(1925).—The conclusion of Quagliariello (cf. *C. A.* **17**, 1250, 1806), that methemoglobin contains less O than oxyhemoglobin, is confirmed. Cf. *C. A.* **19**, 3302.

L. W. RIGGS

Internal secretion of the parathyroid glands. J. B. COLLIP. *Proc. Nat. Acad. Sci.* **11**, 484-5(1925).—The general principles involved in the prepn. of the product are dissolution of the gland by controlled acid hydrolysis and isoelec. fractionation of the active principle. The hormone so obtained is sp. for parathyroid tetany in dogs. The physiol. effects of the active principle are related mainly to the Ca metabolism. The degree of increase of Ca in the blood is directly related to the amt. of the principle injected. A method of physiol. standardization has been developed along these lines, which permits a detn. of the potency of the exts.

L. W. RIGGS

Salt metabolism in the placenta. K. VON OETTINGEN. *Zentr. Gynakol.* **49**, 1614 (1925); *J. Am. Med. Assoc.* **85**, 786.—Under normal conditions the fetal blood obtained from the umbilical cord contains about 4.5% more chlorides than the simultaneously drawn maternal blood. The av. phosphate contents in the 2 sources are 5.33 and 3.51 mg., resp. The creatinine does not show any significant differences. The fact that the umbilical cord blood has a higher concn. of crystalloids points to the exchange between fetal and maternal circulation as not being merely an osmotic process, but that the placental tissue must have some kind of active secretory function. K⁺, Na and amino acids are found in larger amts. in fetal blood than in maternal blood.

L. W. RIGGS

Possible relationship between guanidine and high blood pressure. R. H. MAJOR. *Am. J. Med. Sci.* **170**, 228-32(1925).—Possibly there may be some relationship between guanidine and arterial hypertension but whether the high blood pressure is caused by an increased production of guanidine due to metabolic abnormality or is due to a faulty excretion by a damaged kidney is not detd.

G. H. SMITH

Physiology of high altitudes. A. LOEWY. *Arch. ges. Physiol.* (Pflüger's) **207**, 632-70(1925).—The manifestations of reduced air pressure and the associated diminution in O tension occurring at high altitudes are referable to the reduced O intake. This is true as regards the changes in respiration and blood pressure, but it is by no means possible to assume that the O tension and the amt. of O in the arterial blood indicate an adequate or an insufficient O supply in the tissues, for this depends upon the blood

supply to the tissues. Consequently different tissues show different degrees of O utilization and a differing degree of irritability as a result of the substances formed in them because of the deficiency of O. The fundamental process concerns the O tension in the tissues themselves, and the relationship as existing in the different functional cell complexes, and in the same tissue or organ at different times varies very widely in accord with the reduced O intake, the variable loss of O from the arterial blood, and the peculiarities, anatomical and functional, of the capillary system. Some regions of the body are extremely sensitive to changes in the O intake, and show a manifest effect when the altitude is only moderately high. Examples of such tissues are the respiratory center and the bone marrow. The vasomotor center is less susceptible. The variations which occur in the protein and in the total metabolism are not readily explained, but they may possibly be due to a disturbance in the activities of the endocrine glands. The so-called general O deficiency is essentially an organ deficiency involving particularly the cerebral cortex. Unquestionably the acidosis which occurs is of significance, and the conditions under which it may occur, and its degree as well, are revealed by the CO_2 - and O-binding power of the blood better than by detns. of the amt. of lactic acid present. The essential reaction of the body to high altitudes involves changes in particularly sensitive organs.

G. H. SMITH

Oxygen utilization and the blood flow volume of the eye. TOSHIRO KANEKO. *Arch. ges. Physiol.* (Pflüger's) 208, 122-30(1925).—By detg. the difference in the O content of the blood of the carotid and in that of one of the vortex veins in the dog a measurement of the amt. of O used was obtained. In daylight the value was 4.79 vol.-%, a figure which is increased with strong illumination by some 5-fold, and to twice its value by warming. Cooling causes a diminution. The blood flow changes always in the same direction as the O utilization, and when at rest detns. indicate that it is 0.375 cc./min., being increased 17-fold by strong illumination, 3- to 4-fold by warming, and diminished by some 30% by cooling.

G. H. SMITH

Mammals deprived of liver. I. Significance of the liver for the formation of the bile pigments in mammals. E. MELCHIOR, F. ROSENTHAL AND H. LICHT. *Arch. expil. Path. Pharm.* 107, 238-59(1925).—The parenchymatous cells of the liver are probably the source of the bile pigment formation in mammals.

G. H. SMITH

The regulating principle in the metabolism of warm-blooded animals. FRANZ GROEBBELS. *Arch. ges. Physiol.* (Pflüger's) 208, 661-8(1925).—With 8 species of animals, including birds and mammals, the respiratory rate was compared with the O utilization, showing that the O use per respiration within a single individual is the same for different exptl. temps., and that the O utilization per respiration per 100 g. of animal is the same for different sized animals of a single species. In all species studied the no. of respirations increase as the temp. is reduced and the O used changes accordingly. At a given temp. large animals have a slower rate than do smaller animals of the same species (with white rats and rabbits the reverse is true). For a given animal where these conditions hold the O utilization can be computed from the no. of respirations, the wt. of the animal, and the relative metabolic respiratory const.

G. H. SMITH

3—PATHOLOGY

H. GIDEON WELLS

Mechanism of syphilitic serological reactions. The protein fractions of human blood serum. R. STERN. *Biochem. Z.* 144, 115-37(1924); cf. *C. A.* 18, 413.—A study has been made of the protein fractions of syphilitic and non-syphilitic sera. The so-called euglobulin fraction, comprising a small part of the water-insol. globulin, has no significance for the typical serological reactions in syphilitic conditions. This is called "Labileglobulin." The sepn. from sera of a true euglobulin is described and this on peptization in "Normosal" (Sächsischen Serumwerke) gives positive or negative Wassermann and Sachs-Georgi reactions according to the reaction of the original serum. The residual serum after removal of the euglobulin gives uniformly negative results, whether sepd. into its fractions or otherwise. The elec. charge of the euglobulin responsible for the sp. reactions bears no relation to the positive or negative nature of the tests. Tannin solns. may convert negative into positive sera, and may themselves react positive to the Wassermann and Sachs-Georgi tests. It is tentatively suggested that the sp. action of the euglobulin is due to dehydration in accord with the action of tannin in sensitizing dyestuff solns.

B. C. A.

Induced reactions and diabetes from the point of view of induced oxidation. N. M. MITTRA AND N. R. DHAR. *J. Phys. Chem.* 29, 376-94(1925).—Although HgCl_2 is not reduced by solns. of Na arsenite alone, yet in the presence of another reducing

agent such as Na sulfite, Na phosphite, or formic acid, it is reduced by both simultaneously. Similarly, it is possible to oxidize solns. of NaNO_2 , K oxalate, Na arsenite, or Ni(OH)_2 by air or O when in the presence of Na sulfite, which in its turn is itself oxidized. The amt. of oxidation of Ni(OH)_2 induced by the presence of Co(OH)_2 increases with the concn. of NaOH to a max. and then falls with further increase in alkali. Dextrose can be oxidized by passing air through solns. which also contain Na sulfite. These induced oxidations are due to the formation of active O mols. in one reaction which are then capable of reacting with the second substance present. Diabetes is due to insufficient oxidation of dextrose and fat in the human body, and the action of insulin, etc., is to induce this oxidation in a similar manner to the reactions which have been investigated. The authors suggest that Fe preps. should be helpful in the treatment of diabetes. B. C. A.

Secretion of a dye as a method of functional liver examination. J. L. A. PEUTZ. *Nederl. Tijdschr. Geneeskunde* 69, II, 809-18(1925).—Tetrachlorophenolphthalein injected intravenously is taken from the blood chiefly by the liver. In a disturbance of the hepatic function a retention in the blood takes place. R. BEUTNER

Disturbance of the cystine metabolism in children in connection with animal experiments. G. O. E. LIGNAC. *Nederl. Tijdschr. Geneeskunde* 69, II, 819-27(1925); cf. C. A. 19, 102, 1309.—Following chronic meningitis, a child became profoundly atrophic; after death extensive cystine deposits were found in the kidney. L. holds that the real nature of this atrophie was a lack of assimilation of that amino acid which is indispensable for life. R. BEUTNER

Colloidal reactions in body fluids (blood, cerebrospinal fluid, urine). O. REHM. *Munch. med. Wochschr.* 71, 1793-5(1924).—When equal vols. of benzene, toluene, etc., and normal body fluids were shaken 1 min. no turbidity nor foam or gel formation occurred. Foaming and the formation of films on the surface occurred in pathol. fluids, especially in fluids from luetic patients, when similarly treated and is evidence of a change in the colloidal makeup of these fluids. F. A. CAJORI

Hyperglucemia produced by air injection into the udder of lactating animals. E. M. P. WIDMARK AND O. CARLENS. *Biochem. Z.* 158, 1-10(1925).—The injection of air into the udder of cows causes a marked hyperglucemia of short duration. Glucose appears in the urine when the blood sugar value rises above 0.1% which seems to be the threshold value for cows. To the hyperglucemic action is ascribed the value of air injection into the udder in cases of paralysis puerperalis in cows. F. A. CAJORI

Hypoglucemic symptoms in cows. E. M. P. WIDMARK AND O. CARLENS. *Biochem. Z.* 158, 81-6(1925).—Symptoms similar to those seen in dogs and men following excessive insulin injection were produced in cows with 200 to 500 units of insulin. The blood sugar during the symptoms was 0.030 to 0.037%. In normal lactating cows a blood sugar as low as 0.040% has been observed with none of the symptoms attending massive insulin administration. F. A. CAJORI

Glucolysis. E. NEGELEIN. *Biochem. Z.* 158, 121-35(1925).—Anaerobic and aerobic glucolysis in Flexner-Jobling rat carcinoma gives rise to lactic acid only. F. A. CAJORI

Immunity, with special reference to specificity, and the influence of non-specific factors. II. Chemical structure and specificity. P. HARTLEY. *Brit. Med. J.* 1924, II, 1099-1100.—A review. III. The specificity of acquired immunity and non-specific factors in immunization. T. J. MACKIE. *Ibid* 1100-2.—While sp. immunization must be regarded as the most effective method by which tissue resistance is increased, the development of an acquired sp. immunity or the output of sp. antibodies may be influenced secondarily by non-sp. or heterologous effects. V. The effect of physical and chemical agencies on bacterial vaccines. L. S. P. DAVIDSON. *Ibid* 1103-7.—Antigenic values of detoxicated and defatted vaccines are in no way comparable with those of the ordinary heat-killed bacillary emulsions in saline, whence it would appear that the phys. and chem. processes involved in the prep. of the former are responsible for the marked loss of antigenic value. A. T. CAMERON

The unknown factors of gout. W. J. SMITH JEROME. *Sect. Therap. Pharmacol., Proc. Roy. Soc. Med.* 18, 17-20(1925).—It is suggested that during an infection some cells are liable to succumb to the action of the virus, while others are less seriously affected. The nuclein derived from the former may yield abnormal (gelatinous) uric acid, while that from the latter yields normal cryst. acid, which is gradually and more or less continuously excreted. The gelatinous uric acid is retained within the circulation for 3 or 4 days, coinciding with the period of retention preceding or accompanying the onset of the acute attack, when renal excretion is apt to be subnormal. The colloidal anions, though incapable of passage through the kidney cells, can pass through

the permeable capillaries in cartilage and other Na-rich tissues, and are there pptd. as Na biurate, the pptn. resulting in decrease in Na ions, and being, therefore, followed by partial resoln., with simultaneous excretion of the biurate with the acid, accounting for the abnormally high renal uric excretion at the acme of a gouty paroxysm. Removal of Na in such tissues unbalances the cations and renders them toxic, exciting pathological reactions, sometimes in the form of Ebstein's necrosis and at others as a milder form of inflammation.

A. T. CAMERON

The sugar metabolism of a diabetic (depancreatized) dog during pregnancy and treated with insulin. J. MARKOWITZ AND W. W. SIMPSON. *Trans. Roy. Soc. Can.* 19, Sect. V, 71-7(1925).—As the animal's wt. increased during pregnancy her N excretion diminished. Fecal N remained const., and diet was kept const. The sugar excretion remained level throughout the entire period of pregnancy. It is thought that the amt. of insulin secreted by the fetuses would be too small materially to affect the glucose balance of the mother, when considered with the large amt. of insulin injected (16 units, twice daily). Within 24 hrs. following parturition (3 normal pups; 2 dead) hyperpnea, salivation and hypoglycemia developed. The latter is attributed to milk formation. Blood sugar remained low during lactation, and for some time after weaning. At this stage there was no high glucosuria, and the animal apparently put on fat, regaining normal wt., at which time her sugar excretion was practically identical, on the same diet and insulin dose, with that immediately before pregnancy.

A. T. CAMERON

Cholesterol esters of the blood in tuberculosis. H. C. SWEANY. *Am. Rev. Tuberculosis* 10, 329-33(1924).—The most noteworthy chem. changes of the blood in tuberculosis is in the lipoids (cf. Swany, Weathers and McCluskey, *C. A.* 18, 1143). The total cholesterol of the plasma decreases below the total cholesterol of the cells in exudative tuberculosis and *vice versa* in proliferative tuberculosis. There is little, if any, cholesterol ester in the corpuscles. Cholesterol esters in the plasma increase to about 3 times the normal values in healing fibroid phthisis. The ester-free cholesterol ratio also increases to about 3 times the normal value in the proliferative type. The ester concn. decreases to nearly half the usual value in unfavorable and terminal cases.

H. J. CORPER

Alkaline reserve of the blood during the insulin treatment of diabetes. P. MALCOVATI. *Boll. soc. med. chir. Pavia* 36, 493-505(1924); *Physiol. Abstracts* 10, 105.—Insulin treatment in cases of diabetes with symptoms of acid intoxication restores the alk. reserve of the blood to the normal level sooner and more completely than the tolerance for glucose.

H. G.

Does the specific Gruber-Widal reaction rest upon the same physico-chemical basis as the nonspecific and does the rapidity of erythrocyte sedimentation run parallel in the first as in the second reaction? JOSEF VORSCHÜTZ. *Centr. Bakt. Parasitenk. I Abt.* 90, 105-9(1923); *Abstracts Bact.* 8, 260.—Nonspecific positive Widal reactions occur (1:200) as the result of inflammation whereby an increase in the serum globulins is produced at the expense of the albumins. A comparison of specific and nonspecific agglutination with the hemagglutination showed that the latter is not based upon the same physico-chem. laws as the sp. positive Widal reaction.

H. G.

The blood, urine, and tissue juices in azoturia.—A second report. C. E. HAYDEN. *Cornell Vet.* 14, 158-65(1924); *Expt. Sta. Record* 52, 684.—H. finds that in the blood of the horse in azoturia there appears to be a moderate av. increase in some of the extractives, notably that of the total nonprotein N and sugar, though this is not true in all cases. Increases in individual cases tend to raise the av., but those cases showing the greatest individual increase are not always the worst cases insofar as clinical symptoms go. There is not enough increase in the extractives in either av. or individual readings to justify the claims that the blood is loaded with extractives or that there is uremic poisoning to the extent that it might be the cause of the disease. The quantity of sugar found in av. or individual cases so far also does not justify the claim that azoturia might be due to disturbed carbohydrate metabolism. Urine findings so far still do not indicate a nephritis of enough severity to be the cause of azoturia or of an uremia which might be severe enough to cause the disease.

H. G.

The acid-base equilibrium in diabetic coma: a study of five cases treated with insulin. A. V. BOCK, H. FIELD, JR., AND G. S. ADAIR. *J. Metabolic Research* 4, 27-64(1923); *Physiol. Abstracts* 9, 470.—The mode of administration of insulin, the administration of bicarbonate, the reaction of the blood and the alveolar CO₂ are recorded and discussed. A rough method of detg. the amt. of fixed acid in the blood is developed. A sample of normal blood is titrated with AcOH and the amts. added are plotted against the CO₂ content at 40 mm. Hg. This curve is then used to det. the acid present in the patients' blood by detg. the CO₂ content of the latter at 40 mm. A case is recorded in

which the acidosis was in large part due to acids other than those of the ketone group.

H. G.

Studies of the thyroid apparatus. XXI. The water content and refractive index of the blood serum of albino rats thyroparathyroidectomized and thyroidectomized at 75 days of age. F. S. HAMMETT. *J. Metabolic Research* **4**, 65-72(1923); *Physiol. Abstracts* **9**, 474; cf. *C. A.* **18**, 854.—The water content of the serum is reduced and the n increased in rats deprived of the thyroid app. This is less pronounced in the animals deprived at 75 days than in those at 100 days of age. In the parathyroidectomized rats (at 75 days) the water content is increased in the males and decreased in the females, while the n changes are again the reciprocal of the water changes in each case. Age and sex are both factors in the serum changes following thyroid and parathyroid deficiencies.

H. G.

The blood sugar in Addison's disease. G. MARAÑÓN, E. CARRASCO AND A. SOLER. *Rev. Sud-Americana* **8**, 23(1925); *Physiol. Abstracts* **10**, 107.—Hypoglucemia is always present in Addison's disease. As the blood pressure falls so does the amt. of blood sugar.

H. G.

Lactic acid secretion in patients with carcinoma. K. GLAESSNER. *Wien. klin. Wochschr.* **37**, 358(1924); *Abstracts Bact.* **9**, 110.—Most patients with carcinoma excrete lactic acid in the urine after the intravenous injection of glucose, whereas other patients do not. Mice bearing transplanted carcinoma also give this reaction after introduction of glucose.

H. G.

The production of antiagglutinins. R. R. HYDE AND E. I. PARSONS. *Am. J. Hyg.* **5**, 245-9(1925).—The authors fail to confirm the work of Ford (*Z. Hyg.* **40**, 363-72 (1902)) who maintains that normal and immune agglutinins are qualitatively the same. No evidence for the existence of anti-hemagglutinins could be ascertained and the existence of this class of antibodies is questioned.

W. F. GOEBEL

Studies in calcification. III. A quantitative study of the equilibria concerned with the calcification of bone. L. E. HOLT, JR. *J. Biol. Chem.* **64**, 579-87(1925); cf. *C. A.* **19**, 3275.—The ion product for $\text{Ca}_3(\text{PO}_4)_2$ in blood serum is smaller in active rickets than when the disease is absent or healing, but, even in active rickets, is greater than is required to ppt. $\text{Ca}_3(\text{PO}_4)_2$. It is suggested that calcification is not completely arrested but merely retarded so that bone growth exceeds it in rapidity. The ion product is a more accurate criterion of the rate of deposition of $\text{Ca}_3(\text{PO}_4)_2$ and hence of the activity of rickets than is the empirical $\text{Ca} \times \text{P}$ product, because the latter does not consider the p_{H} nor properly emphasize the effect of variations in Ca . A table for the values of $p(\text{PO}_4^{3-})$ for different values of p_{H} is given. This permits calcn. of ion product if Ca concn. (Ca is assumed to be completely dissociated) and molar concn. of total inorg. PO_4 are known.

I. GREENWALD

The rate of elimination of ingested sugars in phlorhizin diabetes. H. J. DEUL, JR. AND W. H. CHAMBERS. *J. Biol. Chem.* **65**, 7-29(1925).—After the ingestion of 16 g. of the sugar by phlorhizinized dogs, the "extra sugar" in the urine accounted for 105-107% with glucose, 93-96% with fructose, 88% with galactose but only 50% with lactose. In each case there was a sparing action on N , metabolism and an apparent improvement in the general condition of the animal.

I. GREENWALD

A comparison of the concentrations of inorganic substances in serum and spinal fluid. BENGT HAMILTON. *J. Biol. Chem.* **65**, 101-15(1925).—"In a series of 17 cases of epilepsy normal concns. of Cl (Fiske and Sokhey, *C. A.* **19**, 2075), HCO_3 (Van Slyke, *C. A.* **11**, 2208), inorg. P (Fiske, *C. A.* **16**, 742), total fixed base (Fiske, *C. A.* **16**, 2158) and Ca (Kramer and Howland, **14**, 2938, except that the ppts. were allowed to stand overnight, were ignited and titrated with 0.01 N HCl), were found in serum and spinal fluid. The study was extended to other conditions. . . The correlation between Cl in serum and Cl in spinal fluid was not very marked, probably because of the small range of the values in the cases studied. A close relationship was found between values for HCO_3 in the 2 fluids. The correlation between the values for Ca was fairly good and was somewhat less close between the values for inorg. P . Univalent base showed about the same low degree of correlation as Cl and probably for the same reason. . . Of the 3 ratios HCO_3 in fluid/ HCO_3 in serum; Cl in fluid/ Cl in serum; univalent base in serum/univalent base in fluid, the first was very variable, the last 2 were rather const. . . The ratio $\text{Cl} + \text{HCO}_3$ in fluid/ $\text{Cl} + \text{HCO}_3$ in serum was rather const. and usually in close agreement with the ratio for univalent base."

I. GREENWALD

The influence of infection on the lipoids of the suprarenal gland. E. J. BAUMANN AND OLIVE M. HOLLY. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* **63**, lxiii-lxiv(1925).—"In the suprarenals of normal guinea pigs the av. 'fat' (total $\text{EtOH-Et}_2\text{O}$ ext. less cholesterol and phosphatides), cholesterol and phosphatide contents were 7.7, 3.7 and 1.8%,

resp., while in animals that died of various infections the corresponding av. values were 11.2, 1.0 and 2.2%. . . The av. 'fat,' cholesterol and phosphatide percentages of the suprarenals of 25 normal rabbits were, resp., 13.2, 8.8 and 2.5%. The corresponding values in 9 rabbits that died of pneumonia, peritonitis, etc., were 13.8, 4.8 and 2.8%. Thirteen rabbits, sacrificed because of obvious illnesses, which proved on necropsy to be similar infections, show averages of 16.0, 11.1 and 2.2%, resp. It would appear that during the early stages of these infections an increase in the cholesterol content of the suprarenal occurs, which is followed by a decrease later in the disease." Confirmatory evidence is found in the fact that 4 rabbits killed while suffering from a mild and localized middle ear infection gave av. values for "fat," cholesterol and phosphatide content in the suprarenal of 8.5, 20.6 and 2.6%, resp. Among the normal guinea pigs, the variations in lipid content of the suprarenals were small but these were large among the normal rabbits, probably because the stock had been exposed to snuffles, although none had been detected in the animals used.

I. GREENWALD

The relation between the undetermined nitrogen of the blood and its toxicity to *Lupinus albus* seedlings. J. M. LOONEY AND D. I. MACHT. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, ix-lxi(1925).—The index of growth of lupine seedlings in the blood of psychotic patients was detd. In 8 of the samples the index of growth was 75%; in these the undetd. N was 14% of the total non-protein N. In 19 others, the index of growth was 53.5%; in these the undetd. N was 19.5% of the total non-protein N.

I. GREENWALD

Anaphylaxis with bacterial nucleoproteins. B. POLETTINI. *Sperimentale* 79, 289-307(1925).—In the rabbit, but not in the guinea pig, nucleoproteins of cholera, typhoid and paratyphoid A and B organisms produced a state of anaphylaxis when injected subcutaneously or intravenously. Although tests with various proteins showed that the allergy so produced was not specific, animals completely immunized to a given nucleoprotein could be made anaphylactic by the injection of the protein of one of the other bacterial species mentioned.

M. HEIDELBERGER

Agglutinins. D. VANNUCCI. *Sperimentale* 79, 379-400(1925).—The agglutinating power of rabbit and dog sera was investigated after injection of the animals with typhoid vaccine through the ear or mesenteric veins or the carotid or femoral artery, followed by splenectomy in some cases. The results are believed to indicate the origin of the agglutinating antibodies in the hematopoietic organs, especially the hematic portion; also that after the injection of antigen it is rapidly eliminated by the hepatic or renal route, and that when the agglutinating titer of the serum decreases the agglutinins are eliminated in the same way.

M. HEIDELBERGER

The uric acid and creatinine content in the blood of healthy and diseased children. GIOVANNI DE TONI. *Pediatrics* 33, 707-14(1925).—Children from 1 to 12 years presented neither hyper-creatinemia nor excess of uric acid. The creatinine content was always normal, the uric acid content sometimes lower than that reported by other authors.

MARY JACOBSEN

Nitrituria. R. M. GREENTHAL. *Am. J. Diseases Children* 30, 321-7(1925).—A positive nitrite reaction in freshly passed urine is present at times in about 50% of the cases of pyuria due to nitrate-reducing organisms. A positive reaction is valuable as an aid to diagnosis, but a negative reaction has no significance. The failure of the nitrite test in these cases is due chiefly to a lack of nitrate salts in the urine.

I. N. K.

A study of the effects of pyloric obstruction in rabbits. J. L. GAMBLE AND M. A. McIVER, WITH THE ASSISTANCE OF P. MARSH. *J. Clin. Invest.* 1, 531-45(1925).—The stomach contents of control and operated rabbits were analyzed directly, since rabbits cannot vomit. Large losses of H_2O , fixed base and Cl ion from the plasma into the stomach were demonstrated in the animals with obstruction. The changes in the plasma correspond to these losses. In the rabbit there is also a large reduction of bicarbonate in the plasma. Repair cannot occur because of the low availability of the required electrolytes in other body fluids. The skin is a much more important source for Na ion and Cl ion than skeletal muscles.

LOUIS LEITER

Oxygen consumption in dementia precox. J. C. WHITEHORN AND K. J. TELLOTSON. *Bost. Med. Surg. J.* 192, 1254-6(1925).—Persons diagnosed as having dementia precox tend as a rule toward significantly slower rates of O consumption, under approx. "basal" conditions, than would normally be predicted. These slow rates are quite persistent in individual cases.

JULIAN H. LEWIS

The antigenic properties of tissue fibrinogen. CORNELIA M. DOWNS. *J. Infectious Diseases* 37, 49-52(1925).—A protein which is an active blood coagulant and which has antigenic properties distinct from the serum antigens can be pptd. with 0.002 N acid from NaCl soln. exts. of lung tissues. Proteins that are chem. and antigenically

identical with the lung protein can be isolated from liver and kidney exts. These proteins show species specificity in their antigenic properties but not in their action in blood clotting.

The formation of antibodies to sheep blood in experimental tuberculosis. JULIAN H. LEWIS
HEKTOEN AND H. J. CORPER. *J. Infectious Diseases* 37, 81-6(1925).—A rapidly fatal general tuberculosis in the rabbit from the intravenous injection of virulent bovine tubercle bacilli was without definite effect on the agglutinin and lysin content of the serum even to within a few days of death, while precipitin formation seemed to be slightly retarded. Local subcutaneous tuberculosis in rabbits produced by the injection of avirulent human tubercle bacilli 10 and 26 days before the intraperitoneal injection of sheep blood had no appreciable effect on lysin or precipitin formation, but the 2 rabbits given sheep blood 43 days after infection maintained high sp. lysin and precipitin titers for 200 and 445 days. Whether the tuberculosis was the cause of the unusual reaction of these 2 rabbits has not been detd., but the results are similar to those that Lewis and Loomis (*C. A.* 19, 125) obtained in tuberculous guinea pigs. Rabbits infected subcutaneously with avirulent tubercle bacilli and given sheep blood intravenously at different intervals after infection revealed slight variations in antibody formation from the usual course. Tuberculosis in the rabbit, either general or local, apparently has no marked influence on the antibodies that develop from the injection of sheep blood. In exceptional cases, it may result in a prolongation of antibody accumulation in the blood.

The protective substance in antipneumococcic serum. I. Type 1 serum. I. D. FELTON. *J. Infectious Diseases* 37, 199-224(1925).—The protective antibody in type 1 antipneumococcic serum, so far studied, is in large part associated with a H_2O insol. globulino, which is pptd. by diln. 1:10 in H_2O acidulated by varying amts. of HCl , o -phthalic, phosphoric, tartaric and citric acids in a range of H -ion concn. between p_H 5.5 and p_H 7.8. The optimum H -ion concn. for pptn. when the serum is dild. 1:10 has not been definitely detd. The amt. of protective substance obtained in dilg. serum 1:10 is apparently increased by the use, in concn. of /200 to /400, of phosphate buffers. With the single sample of serum pptn. of type 1 antibody by 50% satn. with $(NH_4)_2SO_4$ failed to give a yield as high as simple diln. with H_2O 1:10. $CHCl_3$ denatures globulin and destroys the protective action of antibody to a degree corresponding to the extent of the removal of protein from the soln. Extn. with Et_2O in acid or $NaCl$ soln. destroys a considerable part of the protective value of this globulin, while in alk. soln. 5 hr. extn. has little or no effect. An apparent exception to the association of the protective body with the H_2O fraction of serum is given in the case of a sample of horse serum possessing protective value, but yielding little protective ppt. In relatively abundant ppts., there seems to be a direct relation between the protective value of the ppt. and the yield. The ppt. obtained by diln. of serum from horses immunized but a short time has less protective value per mg. of N than the ppt. from horses immunized over a longer period. Heat alters the type 1 antipneumococcus serum so that no ppt. results from diln. with 10 vols. of distd. H_2O . On the addition of acid, a ppt. is formed which has less protective power than the unheated control.

Quantitative changes in blood sugar and blood lactic acid in canine anaphylaxis. JULIAN H. LEWIS
MARCEY McCULLOUGH AND F. I. O'NEILL. *J. Infectious Diseases* 37, 225-8(1925).—Horse serum injected intravenously into normal dogs causes a gradual increase in the sugar content of the blood, the blood sugar rising to about twice the normal percentage by the end of 2 hrs. This increase indicates a toxic action of horse serum on normal dogs, not shown by changes in arterial blood pressure, the currently used index in canine anaphylaxis. Horse serum injected intravenously into dogs that failed to become sensitized by an injection of horse serum 3 weeks previously, called "negatively sensitized" dogs, causes no changes in blood sugar during the first 2 hrs. These dogs, therefore, are resistant to the normal toxicity of horse serum, and should be regarded as immune. During typical canine anaphylactic shock, the blood sugar increases rapidly, reaching nearly twice the normal concn. by the end of 20 min. The blood sugar then gradually decreases, being but slightly above normal by the end of 2 hrs. After the first 15 min., the curve thus obtained is identical with the blood sugar curve obtained by intravenous injection of an amt. of glucose equiv. to the total estd. glycogen content of the liver. During typical anaphylactic shock, the blood lactic acid increases to twice the normal concn. within the first 30 min., gradually falling to about 40% above normal by the end of 2 hrs.

Quantitative changes in tissue glycogen, blood sugar, plasma, inorganic phosphates and in blood lactic acid in canine histamine shock. JULIAN H. LEWIS
K. W. THOMPSON. *J. Infectious Diseases* 37, 229-31(1925).—The changes produced by

histamine shock in dogs are similar to those in anaphylaxis as reported by McCullough and O'Neill cf. preceding abstr. (O'Neill, Manwaring and Moy, *C. A.* 19, 1896). The main difference between them is that the max. changes in histamine shock are not reached until the end of 30 min., instead of at the end of 15 min. as in anaphylaxis.

Extracts of normal tissues in experimental tuberculosis. JULIAN H. LEWIS. *J. Infectious Diseases* 37, 256-64(1925).—The inoculation of simple unincubated saline exts. of liver, kidney, spleen, adrenal, heart and lungs appears to influence the development of exptl. tuberculosis in rabbits. Exts. of adrenal and lung frequently retard the disease, those of heart and liver produce less effect, while exts. of spleen and kidney exert little or no effect. The freshness of the organs used, the short time used in prep., the exts., the avoidance of incubation and the preservation of the exts., between inoculations, at icebox temp. make it seem possible that the more or less protective substances present in some of the organ exts. exist in the organs before removal from the animal.

Criticisms of the Robonyi-Lax theory of uremia. ERWIN BECKER. *Zentr. inn. Med.* 45, 162-9(1924).—Robonyi and Lax (*Z. klin. Med.* 93(1922); *Klin. Wochschr.* No. 3(1923)) believe uremia not to be due to an insufficiency of the kidneys but to a change in the permeability of the tissues and a lowering of their affinity for N. Fallacies in their argument are developed by B. and facts which do not corroborate those upon which their theory is based are reported.

Hydrating effect of plasma and of serous fluids (exerted upon muscle tissue) of edematous subjects. MARCEL LABBÉ AND P. L. VIOLLE. *Compt. rend. soc. biol.* 92, 963-5(1925); cf. *C. A.* 19, 3309.—The frog gastrocnemius, which upon immersion in the plasma of normal subjects loses wt., on the contrary gains wt. through imbibition of water when placed in plasma obtained from patients suffering with edema. This is evidently not due to acidity of the biological fluid, because plasma obtained fresh from diabetic patients who died in extreme coma had the same effect as does the plasma from normal subjects.

Tissue glucolysis in experimental diabetes. P. MAURIAC AND E. AUBERTIN. *Compt. rend. soc. biol.* 92, 1101-3(1925).—A comparison of the blood sugar of arterial and venous origin both before and after insulin administration shows that frequently there is no difference in either normal or diabetic animals between the 2 or if the blood sugar is sometimes lower in the vein than in the artery (femoral) the exact opposite of this is likewise known to occur.

Glucose content of the blood in anthrax animals. Effect of insulin and of glucose serum on the development of the anthrax infection. G. CORDIER. *Compt. rend. soc. biol.* 92, 1307-8(1925).—Glucose content of the blood of animals affected with anthrax is subject to such irregularity as to make it impossible to say whether insulin and glucose-serum administration either accelerates or retards the infection.

Physicochemical changes in serum following an antigen injection. P. LÉCOMTE DU NOÛY. *Compt. rend. soc. biol.* 93, 14-5(1925).—The surface tension of serum diminishes following the injection of any kind of antigen, the phenomenon appearing 8 days and reaching a max. 13 days after the injection.

Uric acid content of blood, plasma in pathological conditions. Relation between free and total uric acid. C. M. JONES. *Compt. rend. soc. biol.* 93, 299-300(1925).—Although the total uric acid content is much increased in nephritis, the proportion of free uric acid is generally diminished. In liver diseases the total uric acid content is within normal limits or is somewhat increased but the free uric acid is almost always lowered. In arthritis the administration of cincophen causes a marked drop in the uric acid (50%) which affects principally the free uric acid.

Changes in acid-base equilibrium of the cerebrospinal fluid in experimental acidosis. R. CESTAN, M. SENDRAIL AND H. LASSALLE. *Compt. rend. soc. biol.* 93, 475-8(1925).—The changes in alk. reserve of both blood and cerebrospinal fluid are parallel, those of the blood preceding. The changes in p_H of the blood and cerebrospinal fluid, on the contrary, are not the same and depend upon the method of producing the acidosis. Thus, following intravenous injections of HCl the cerebrospinal fluid may actually become alk. while the p_H of the blood falls very rapidly, whereas in acidosis due to morphine-chloroform intoxication the p_H of the cerebrospinal fluid falls rapidly and to a greater extent even than that of the blood.

Experimental beriberi and insulin. X. CHAHOVITCH. *Compt. rend. soc. biol.* 93, 652-5(1925).—In normal pigeons insulin causes no nervous symptoms except for a lowering of the temp., whereas in pigeons suffering from exptl. beriberi the administration

of insulin causes an aggravation of the disease and calls forth the nervous attacks.

S. MORGULIS

Infantile tetany. R. A. TURPIN. *M. D. Thesis, Paris 1925; Bull. soc. hyg. aliment.* 13, 409-10(1925).—Up till now infantile tetany had been attributed mainly to hypocalcemia or guanidine intoxication (resulting from a trouble in protein metabolism). T. studied more particularly the Ca^{++} (instead of total Ca) content of the blood serum, which alone is biologically active and can modify cellular permeability and excitability. The true cause of infantile tetany is shown to be a disturbance of the acido-basic equil. in the direction of hyperalky. with the resultant deficiency of Ca^{++} . Alkalosis, which involves a decrease in the Ca^{++} content of the humors, would thus cause a state of hyperexcitability of the nervous system and prep. the convulsive discharge, which might subsequently take place only under the action of a specific poison, guanidine and would be the true cause of tetany.

A. PAPINEAU-COUTURE

Precipitin reaction of thyroglobulin. LUDVIG HEKTOEN AND KAMIL SCHULHOF. *Proc. Nat. Acad. Sci.* 11, 481-4(1925).—Thyroglobulin precipitins appear to be sp. for thyroglobulin, but are not consistently species-sp. Thyroglobulin is present as such in the colloid of the thyroid gland. The rabbit can produce precipitin for rabbit thyroglobulin. Thyroglobulin may occur in the blood from the human thyroid vein. The precipitin test does not indicate any difference between thyroglobulin from the normal thyroid and that from exophthalmic goiter. The fetal human thyroid contains thyroglobulin in the third month if not earlier.

L. W. RIGGS

Iodine hyperthyroidism. A. S. JACKSON. *Am. J. Med. Sci.* 170, 271-83(1925).—Persons with adenomatous goiters are particularly liable to develop hyperthyroidism after the administration of even minute quantities of I.

G. H. SMITH

The precipitation of antidiphtheric serum from horses by electro dialysis. R. WERNICKE. *Anales asoc. quim. Argentina* 23, 149-53(1925).—A serum diluted 1:5 and electro dialyzed 72 hrs. until $K = 1 \times 10^{-6}$ retained 30% of its initial antitoxic value, 26% when diluted 1:1 with KCl = 0.01 N and electro dialyzed 112 hrs. until $K = 1.5 \times 10^{-6}$, 47% when diluted 1:10 and electro dialyzed 72 hrs. until $K = 2.4 \times 10^{-6}$, and 37.5% when dialyzed for 28 days with successive diln. to 1:62.5 and electro dialyzed about 200 hrs. with repeated addns. of KCl until $K = 2.4 \times 10^{-6}$, from which it can be assumed that serum made in the Bacteriological Institute behaves differently from the Adolf serum made in Vienna (cf. C. A. 19, 33). A good part of the antitoxin remains firmly fixed in the sol. proteins, probably united with them and with a small part of the globulin which is the fraction pptd. by $(\text{NH}_4)_2\text{SO}_4$ at semi-satn., and which is so difficult to eliminate by electro dialysis in the presence of albumins.

E. M. SYMMES

H—PHARMACOLOGY

ALFRED N. RICHARDS

The chemistry and chemotherapy of the tropane derivatives. G. M. DYSON. *Ind. Chemist* 1, 403-6(1925).—The relationship between chemical constitution and physiological action of cocaine and its derivs. and of cocaine substitutes is discussed and an account of the progress made in the discovery of atropine and cocaine substitutes is given. Cf. C. A. 19, 3315.

E. R. G. ARDAGH

The influence of carbohydrates, fats, and proteins on the sensitiveness towards insulin. A. GREVENSTUCK, S. E. DE JONGH AND E. LAQUEUR. *Nederland. Tijdschr. Geneeskunde* 69, II, 1008-16(1925).—Feeding expts. on rats seem to show that an excess of carbohydrates as well as a lack of proteins increases the sensitiveness towards insulin; fat seems to exert a protecting influence. The results are not quite definite, however.

R. BEUTNER

The influence of the degree of purity upon the action of insulin. S. E. DE JONGH AND E. LAQUEUR. *Nederland. Tijdschr. Geneeskunde* 69, II, 330-8(1925).—Insulin to which pancreatic protein has been added is resorbed slower. The degree of purity of various com. samples does not vary sufficiently so as to exhibit retarded resorption in some cases.

R. BEUTNER

Intraglobular sulfhemoglobinuria. W. H. J. IVENS AND J. M. VAN Vollenhoven. *Nederland. Tijdschr. Geneeskunde* 69, I, 447-52(1925).—Phenacetin, given to men, produces sulfhemoglobinuria, while *in vitro* it does not act in that way. However, one of its products of decompn., *p*-aminophenol, acts in the presence of H_2S . Apparently phenacetin acts *in vivo* after being decomposed with the aid of CH_2S , resorbed from the intestine.

R. BEUTNER

A substance capable of lowering intraocular pressure. S. E. DE JONGH AND L.

K. WOLFF. *Nederland. Tijdschr. Geneeskunde* 69, I, 2665-71(1925).—The substance detected in the blood of animals, poisoned with convulsant drugs or insulin, which lowers intraocular pressure (cf. C. A. 19, 1453) has the following chem. properties: it is sol. in 30 and in 50% alc., but not in 80%. It can be entirely freed from protein by boiling with AcOH without decompn.; it is decompd. by alkali, but not by acid. It does not act, unless at boiling temp.

R. BEUTNER

The action of physostigmine and pituitrin: The action of these drugs, alone and combined, upon the isolated human vermiform appendix; the advantages of their combined use in post-operative ileus. D. G. T. KERR CROSS. *Brit. Med. J.* 1924, I, 9-12.—These 2 drugs in combination have a more powerful effect in stimulating movements of the intestine than either of them singly, and the combination frequently relieves the condition of severe post-operative atony when either, alone, is ineffective.

A. T. CAMERON

A note on the action of insulin on the blood sugar of the fowl. J. MARKOWITZ. *Trans. Roy. Soc. Can.* 19, Sect. V, 79-81(1925).—The blood sugar is lowered, but to a less extent than in mammals. Symptoms of hypoglycemia occur at a much higher level, over 0.15% (normal 0.23 to 0.25%). The nervous system of the fowl must therefore have sugar normally supplied to it at a higher tension than in mammals.

A. T. CAMERON

Insulin and glycogenolysis. I. L. CHAIKOFF. *Trans. Roy. Soc. Can.* 19, Sect. V, 83-90(1925).—Insulin inhibits asphyxial hyperglycogenolysis in the liver (rabbits), and when, in spite of asphyxia, convulsions occur following insulin injection, the glycogen content of the muscles becomes reduced almost to zero, although, when no convulsions occur, there is no demonstrable change. Expts. suggest that if an animal is to survive a convulsive fit there must be glycogen present in the muscles, and death is due to the absence or almost complete absence of muscle glycogen. A. T. CAMERON

Hippuric acid synthesis in the human organism. II. Behavior of glucuronic acid in the urine after administration of sodium benzoate. G. BIGNAMI. *Boll. soc. med. chir. Pavia* 36, 509-20(1924); *Physiol. Abstracts* 10, 102-3; cf. C. A. 19, 1732.—In man benzoic acid administered *per os* is eliminated as hippuric acid as long as the organism can supply the necessary amt. of glycocholi; subsequently it combines with glucuronic acid and is eliminated as benzoyl glucuronic acid provided the organism has a sufficient supply of glucose; the remainder of uncombined benzoic acid is eliminated as such with the urine and eventually with the feces. III. Diuresis after administrations of sodium benzoate. *Ibid.* *Boll. soc. med. chir. Pavia* 36, 531-45(1924); *Physiol. Abstracts* 10, 102-3 — Na benzoate can be usefully employed as a diuretic in the dose of 20 to 25 g. dissolved in 300 cc. of H₂O *pro die*.

H. G.

Variations in the molecular concentration in organs after the administration of ethyl alcohol. P. TESTONI. *Arch. sci. biol. (Italy)* 6, 403-24(1924); *Physiol. Abstracts* 10, 122- - After the intravenous injection of a given quantity of EtOH into rabbits, the mol. concn. in the brain, heart, kidney, blood and muscles varies according to the length of time which has elapsed between the injection and the death of the animals.

H. G.

The quantitative study of the physiologic action of thyroxin. E. C. KENDALL. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, xi-xii(1925).—"Through a study of closely related compds., synthetically prepd., the fact is demonstrated that thyroxin can exist in 2 forms: reduced and oxidized. Thyroxin, as isolated from the gland, is the reduced form. α -Hydroxyindolepropionic acid. loses 2 atoms of H with mol. O₂ when the pyrrole ring in the mol. is open, and forms a bond from the N to number 7 C in the benzene ring. This compd. has a feeble oxidizing power. When, however, the pyrrole ring is closed and the bond is present from the N to number 7 C, the oxidizing power of the compd. is much increased." The difference in oxidizing potential is at least 0.3 volt. When injected into a normal dog, neither open-ring form produces a visible response, but the oxidized closed-ring form causes a drop in blood pressure, increased pulse and respiratory rate and increased metabolism. Thyroxin is believed to act in an analogous fashion, the reduced form giving off H to mol. O₂, then, by intramolecular rearrangement, becoming an intense H acceptor.

I. GREENWALD

The influence of insulin, administered orally and subcutaneously, in phlorhizin diabetes. O. H. GAEBLER. *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.* 63, li-liii(1925).—"Insulin introduced subcutaneously into dogs completely under the influence of phlorhizin acts immediately to cause a reduced rate of excretion of sugar and an increase in the respiratory quotient. When glucose is given the rate of excretion of N is reduced, but when glucose and insulin both are given it is reduced still more. . . . Insulin administered orally in enteric coated tablets, combined with malic acid, Na

oleate and an amino acid which liberates HCl, has given positive results on the reduction of urine sugar, increase in respiratory quotient and sparing of protein. The effect is much less in amt. than that from subcutaneous administration. The sugar which disappears from the urine and does not reappear may amount to 0.28-0.48 g. per clinical unit of insulin administered subcutaneously. . . . Some of the sugar which disappears from the urine may reappear when the insulin effect wears off, because, as Cori has shown for the rabbit, it may be stored temporarily as glycogen." I. G.

The action of insulin on the acidosis produced by carbohydrate hunger in man. S. J. THANNHAUSER AND H. MEZGER. *Klin. Wochschr.* 3, 1989-91(1924).—Normal individuals were kept 4-6 days on a diet contg. 883 calories, of which 81 calories were supplied by carbohydrate. At the end of the test period the blood sugar value had dropped to 0.06-0.07 g. % and acetone bodies could be demonstrated in the blood and urine. An injection of insulin reduces the concn. of the acetone bodies and of sugar in the blood simultaneously; minimum values are obtained 2 hrs. after the injection. The blood sugar then rises to above its pre-insulin value. The ketonuria is perceptibly reduced 6 hrs. after the injection. MILTON HANKE

Action of insulin. I. The dependency of hypoglycemic cramps on the blood sugar value. ERICH PUTTER. *Klin. Wochschr.* 3, 2239-42(1924).—The cramps that usually follow an overdose of insulin cannot be directly correlated with the blood sugar values. In 500 expts., cramps were obtained in 36.3% of the cases at a blood sugar concn. of 40-50 mg. %, in 32.4 % of the cases at 50-60 mg. %, in 15.7% of the cases at 70 mg. % and in 5.9% of the cases at above 70 mg. %. Seven of the animals had blood sugar values of 34-38 mg. %; but no cramps. The animals were ill even when cramps did not occur. The term hypoglycemic cramps is evidently a misnomer. The term "insulin injury" is suggested as a substitute. MILTON HANKE

Influence of cholesterol on blood and body weight. M. DORLE AND R. SPERLING. *Klin. Wochschr.* 3, 1530-2(1924).—A single treatment with cholesterol gives rise to a marked increase in the erythrocyte count and in the hemoglobin value. The resistance of the erythrocytes to hemolysis (0.4% NaCl) is increased. A protracted treatment gives permanent results as above, and an increase in body weight. Cholesterol may, at times, act as a sedative. Cessation of treatment frequently leads to a temporary, still further increase in the no. of erythrocytes, etc. The treatment is recommended in anemia. MILTON HANKE

Ethylene. L. F. SISE. *Bost. Med. Surg. J.* 192, 287-91(1925).—Ethylene is believed to be the purest anesthetic known since, for a given depth of anesthesia, it produces less effect on the body than any other known anesthetic. It can be used with a larger percentage of O than can N₂O and it gives better relaxation. The relaxation is not as complete as with ether. The serious objection to it is its inflammability. It is the best anesthetic for the handicapped and "bad risk" patient. J. H. L.

Novoprotein treatment in gastric ulcer. L. R. GROTE AND H. BERGMANN. *Zentr. inn. Med.* 45, 337-44(1924).—Intravenous injections of novoprotein gave good results in gastric ulcer and is especially indicated in acute painful ulcers and certain ambulatory cases. Its mode of action is unknown, but it has an action on the blood vessels since it causes adrenaline to be inactive on the blood pressure. Like injections of other proteins there is a general reaction (fever) and a local reaction (hyperemia of the tissues). JULIAN H. LEWIS

The toxicity of urea. ERWIN BECKER. *Zentr. inn. Med.* 45, 229-36(1924).—Urea given to rabbits in doses of 1-2 g. per kg. body wt. produces severe toxic symptoms and death, especially in previously starved animals. Death comes immediately or after several hrs. depending on whether there is a hydremia or thickening of the blood. These changes in blood vol. alone do not account for the toxic action of urea. There seems to be a primary sp. toxicity. Urea N in the blood of these animals never reaches the amts. found in human renal deficiency. JULIAN H. LEWIS

Carbon monoxide poisoning. O. KLEIN. *Zentr. inn. Med.* 45, 489-92(1924).—While the symptomatology of CO poisoning is not uniform, the symptoms referable to lesions of the pyramidal tract (motor irritation) are const. JULIAN H. LEWIS

A record of some recent New Hampshire poisonings. With an observation concerning possible failure to detect the presence of cyanides. CHAS. D. HOWARD. *Boston Med. Surg. J.* 190, 975-80(1924).—This report illustrates the important role that the chem. lab. may play in fixing the guilt in criminal poisoning cases. Seventeen cases are given in which chem. analyses disclosed the cause of death and established the conditions under which it occurred. Attention is called to cases of illness produced by substances labelled as harmless. Two deaths are described from Me salicylate poisoning after the taking of large amts. of a carbonated beverage flavored with essence of

wintergreen. The process of embalming may interfere with the detection of poisons in the tissues. This is particularly true with the detection of cyanides. Expts. are given which show that the usual tests for cyanides fail in the presence of HCHO, the chief constituent of most embalming fluids.

JULIAN H. LEWIS

Effect of secretin and pilocarpine upon the blood lipase of dogs. P. V. PREWITT. *Am. J. Physiol.* 73, 1-4 (1925).—Secretin and large doses of pilocarpine given intravenously increased blood lipase.

J. F. LYMAN

The mechanism of insulin. I. The action of insulin and of the salts of guanidine on the permeability of the mammalian erythrocyte. J. SECKER. *J. Physiol.* 60, 286-92 (1925).—Insulin increases the permeability of the red blood cell to glucose and chlorides. Guanidine, in the presence of Ca, has a similar action.

J. F. L.

Effect of duodenal administration of alkali on digestive secretion. TOSHITANE MATSUYAMA. *J. Biochem. (Japan)* 4, 385-409 (1925); cf. *C. A.* 19, 3111.—Alkali introduced into the duodenum causes a reduction of gastric acidity in man which depends upon the quantity administered as well as the time of administration. If 5 g. of NaHCO_3 in a 10% soln. is given by duodenal tube directly before a test breakfast and the gastric contents are examd. 1 hr. later it is invariably found that its acidity is lower than in control tests. But if the same quantity of alkali is given 1-2 hrs before the test meal there is no noticeable change in the acidity. Likewise, there is no reduction of acidity when only 2 g alkali is given immediately before the test meal. The reduction of the acidity is not due to a regurgitation of the alkali but to a diminution in gastric secretion. However, regurgitation is a factor which must be taken into account. It is suggested that therapeutically, to reduce gastric acidity, NaHCO_3 should be given in relatively large doses and directly before eating. Intravenous injection of even 5 g NaHCO_3 causes no marked change in gastric secretion in man. It does not invariably affect the alk. reserve of the blood measured after $\frac{1}{2}$ hr. showing that the NaHCO_3 is quickly eliminated from the blood. In 2 dogs with Pavlov's stomach a diminished gastric secretion has been occasionally found after intravenous NaHCO_3 injection. Subcutaneous injection of NaHCO_3 directly before a meal causes a reduction in gastric secretion; when, however, the injection is made several min. after food is given there is frequently no diminution. These effects are attributed to the pain caused by the injection and not to the absorbed alkali.

S. MORGULIS

Chemical studies on hematoporphyrin rabbits. II. Relationship between anemia and fibrinogen content of blood. KICHIYA OHTA. *J. Biochem. (Japan)* 4, 463-6 (1925); cf. *C. A.* 19, 3111. Hematoporphyrin rabbits when exposed to sunlight show anemia and an increased fibrinogen content.

III. The fibrinogen content of the blood of hematoporphyrin rabbits. *Ibid* 467-71.—The daily changes in fibrinogen content, hemoglobin and number of erythrocytes in rabbits treated with hematoporphyrin are recorded. For details the original tables must be examd.

S. MORGULIS

Glucolysis and variations in inorganic phosphorus of the blood in vitro; effect of insulin. H. BIERRY AND L. MOQUET. *Compt. rend. soc. biol.* 93, 322-4 (1925).—The addition of insulin to a sample of blood contg. a definite amt. of phosphate-glucose soln. causes a more rapid disappearance of the sugar and P than is observed in control (without insulin) samples in the course of 1 hr at 40°. Cf. *C. A.* 19, 1886.

S. M.

The degree of reinforcing action of organ extracts on the vasomotor influence of adrenaline. NILS BERGGREN. *Compt. rend. soc. biol.* 93, 201-3 (1925).

S. M.

Fate of phenolsulfonephthalein in the organism. ROBERT MOELLER AND C. LUNDSGAARD. *Compt. rend. soc. biol.* 92, 1321-2 (1925).—Phenolsulfonephthalein given intravenously is partly eliminated through the bile, this function being diminished in cases of hepatic disease.

S. MORGULIS

The assumed antisiphilitic properties of cadmium. C. LEVADITI, S. NICOLAU AND A. NAVARRO-MARTIN. *Compt. rend. soc. biol.* 93, 233-5 (1925).—Cd does not possess therapeutic value as a treponemicide as does Ba or V.

S. MORGULIS

Effect of extracts of lymphatic glands, striated muscles and of blood on the action of adrenaline on uterus and intestine. NILS BERGGREN. *Compt. rend. soc. biol.* 93, 197-200 (1925).—There is no evidence that exts. from lymphatic glands have an antagonistic effect on the adrenaline action. In the case of the uterus the effect is synergic and in the case of the intestine it is likewise partly synergic. Besides exts. from striated muscle tissue or from blood have the same effect, so that it is probably a general influence of tissue exts.

S. MORGULIS

Rhythmic movements of skeletal muscles in salt solutions (sodium citrate and barium chloride). SILVIO REBELLO AND J. FONTES. *Compt. rend. soc. biol.* 92, 909-12 (1925).—Solns. of Na citrate and of BaCl_2 of the same p_H and isotonic with blood were used. In the citrate the frog gastrocnemius goes into fibrillations after its tone

is increased. The effect of the Na citrate lasts about $\frac{1}{3}$ of a min. The muscle twitches can be diminished by the addition of K or stopped entirely with Ca ions. In the presence of the BaCl_2 the gastrocnemius commences to contract only after a long interval ($\frac{1}{4}$ – $\frac{3}{4}$ hr.) and its activity continues for hrs. Each contraction begins after the complete relaxation from the previous. These contractions are diminished by K but unaffected by Ca. A mixt. of BaCl_2 and Na citrate produces very strong spontaneous twitches which tend to go over into spasms. S. MORGULIS

Curare paralysis and curare-like paralysis by strychnine. SILVIO REBELLO AND J. FONTÈS. *Compt. rend. soc. biol.* 92, 912–6(1925).—Arguments against the view of the identity of the paralysis by curare and by strychnine. S. MORGULIS

The fate of oil injected subcutaneously. LÉON BINET AND J. VERNE. *Compt. rend. soc. biol.* 93, 421–3(1925).—Oil injected under the skin disappears with extreme slowness, after first being acted on by leucocytes. The resorption is more rapid for animal than for vegetable fats. S. MORGULIS

The determination of "lecithins" and of cholesterol in organs under the influence of general anesthesia. P. MANCEAU. *Compt. rend. soc. biol.* 92, 1507–10(1925).—Under the influence of CHCl_3 and N_2O there is considerable diminution of the cholesterol and lecithin content of the adrenal capsule per kg. of fresh substance. But there is clear evidence of an increased wt. of the adrenals under the influence of the anesthesia. The results with other tissues are very uncertain. S. MORGULIS

Insulin injections into the cerebrospinal fluid. I. I. NITZESCU. *Compt. rend. soc. biol.* 92, 1076–9(1925).—Injections of insulin into the cerebrospinal canal frequently cause no hypoglycemia; the hypoglycemia when produced is usually very feeble; a strong hypoglycemia occurs only rarely and only following large doses. S. MORGULIS

Dissociation of the pupillary and the ophthalmotonic effect of atropine and pilocarpine in glaucoma. E. PISCARIU, V. CERCHEZ AND J. NITZULESCU. *Compt. rend. soc. biol.* 92, 1085–7(1925). S. MORGULIS

Variations in blood sugar resulting from injections of blood taken from an animal treated with insulin. P. MAURIAC AND E. AUBERTIN. *Compt. rend. soc. biol.* 93, 130–2(1925).—The subcutaneous injection of 5 cc. of blood from a normal rabbit into another normal rabbit has no definite effect on the blood sugar content of the latter. When the donor is made hyperglucemic the recipient again shows no definite variation in its sugar, which sometimes rises and sometimes falls following the blood injection. If, however, the blood from an animal made hypoglycemic with insulin is injected subcutaneously into another rabbit, a marked hyperglucemia develops in the recipient lasting generally 4–5 hrs. The blood of the animal treated with insulin seems, therefore, to have acquired the property of exciting the adreno-secretory center. S. MORGULIS

Vagotonic condition and resistance to poisons. A. DE CARVALHO. *Compt. rend. soc. biol.* 92, 918–21(1925).—Hypovagotonia produced by atropinization has no influence on the action and toxicity of nitroprussates, whereas in case of hypervagotonia produced by pilocarpine there is either a lowered resistance of the organism to the poison, if the pilocarpine is administered before or simultaneously with the nitroprussate, or the toxic effects are very greatly increased if the pilocarpine is administered following the poison. S. MORGULIS

Effect of p_H on the chronaxie of the isolated turtle heart. HENRI FREDERICQ. *Compt. rend. soc. biol.* 93, 438–40(1925).—Increased acidity of Ringer soln. prolongs the chronaxie of the heart. S. MORGULIS

Intensification of the cation effect on the isolated auricles through concentration at the Keith node. LUCIEN DELOYERS. *Compt. rend. soc. biol.* 93, 443–6(1925). The concn. of Ca and K ions at the node of Keith increases their effectiveness. Their action upon the heart is instantaneous. S. MORGULIS

Some microrespiration experiments on the effect of insulin on tissue respiration. LEONARD BRAHME. *Acta med. Scand.* 62, 188–96(1925).—The expts. were made on finely cut muscles, whose respiratory exchange was studied in the Thunberg microrespirometer. The procedure was as follows: A series of beakers was filled with 5 cc. of a soln. contg. 2.4% K_2HPO_4 and 0.6% KH_2PO_4 and with 5 cc. of a 0.02% glucose soln. The p_H of this mixt. was about 7.2. To this was added 1 g. of a finely cut frog muscle mass. To a similar series various amts. of insulin were likewise added. The muscle remained in contact with glucose phosphate soln. for 5 min. and the soln. was then quickly poured through a cotton filter. The solid residue was pressed into a very thin uniform sheet and this was placed in the microrespiration app. Detns. of the CO_2 production and O consumption showed that the respiratory exchange was

raised in the preps. contg. the insulin. The greatest increase was observed where the insulin concn. was 10^{-7} – 10^{-9} . On the av. this increase was 42–28% for CO_2 production, and 44–27% for O consumption. With a smaller concn. of 10^{-10} there could be observed no effect, whereas in a strong concn. of 10^{-4} there was actually a diminution of 14 and 17% CO_2 production and O consumption, resp. No evidence was found for alteration in the respiratory quotient in these expts.

S. MORGULIS

Effect of insulin on the glycogen deposit in the liver of a totally depancreatized dog in the state of inanition. E. HÉDON. *Compt. rend. soc. biol.* 93, 596–8(1925).—When a totally depancreatized dog has been starved to the point where it was very improbable that it would contain any glycogen in the liver it was treated subcutaneously with 10 units of insulin. The blood sugar dropped from about 0.2 to 0.5% and at the end of 3 hrs. to 0.02% when the typical hypoglycemic convulsions occurred. The animal was killed, and the liver quickly removed. A large part of this was immediately used for the detn. of the glycogen, and was found to contain 0.63% of glycogen; another portion was left at room temp. for 3 hrs. when it was still found to contain 0.4% glycogen. A third portion was used for histological study, which also revealed the deposit of glycogen. It is shown thus that insulin could affect glycogenolysis within the brief period of 6 hrs. in a totally depancreatized dog.

S. MORGULIS

Toxic effect of the poison of *Adamsia palliata* on various marine invertebrates. J. CANTACUZÈNE AND N. COSMOVICI. *Compt. rend. soc. biol.* 92, 1464–6(1925).—The decapod crustacea are most sensitive to the poison of *Adamsia*. Among the ctenophores, the actinia, and among the molluscs, the cephalopods, are apparently entirely immune to it.

S. MORGULIS

Effect of insulin on the alkaline reserve and the p_{H} of the blood in horses. R. WERNICKE, E. SAVINO, V. DEULOFEU AND G. SCOTTI. *Compt. rend. soc. biol.* 92, 896–8(1925).—Insulin causes a small diminution in the p_{H} and in the alk. reserve, especially noticeable after 3 hrs., in horses treated with insulin.

S. MORGULIS

The behavior of malonic and other dicarboxylic acids in the animal organism in liver perfusion. GORO MOMOSE. *J. Biochem. (Japan)* 5, 441–61(1925).—Malonic acid on perfusion through a glycogen-poor dog liver produces besides AcMe also considerable quantities of another volatile substance which binds I and is destroyed by Ag_2O . The substance is supposed to be aldol. The conversion of the malonic acid into acetoacetic acid is only possible through the intermediate formation of AcOH. The further process is either through a condensation of AcOH with AcH which changes to AcMe through the intermediate step of β -hydroxybutyric acid; or the AcOH is changed to aldol which in turn is converted to AcMe. *d*-Saccharic and *d*-tartaric acids cannot produce AcOH in the isolated perfused glycogen-poor liver. In this case likewise, a substance is formed which binds I and is destroyed by Ag_2O , but in very small amts. It is thought that this substance is also aldol.

S. MORGULIS

Effect of calcium ions on the vegetative system of man. C. POPESCU-INOȚEȘTI. *Compt. rend. soc. biol.* 93, 752–4(1925).—Intravenous injections of Ca in doses of 0.1 to 1 g. cause sympathetic excitation such as tachycardia, hypertension, mydriasis, hyperglucemia and tachypnea. In doses of 1.5 to 4 g. it causes para-sympathetic excitation with the appearance of bradycardia, myosis, hyperglucemia, and slow breathing.

S. MORGULIS

Effect of poisons of *Adamsia palliata* on the heart of *Carcinus maenas*. N. L. COSMOVICI. *Compt. rend. soc. biol.* 92, 1300–2(1925).—The poisons of the tentacles and nematocysts of *Adamsia palliata* act violently on the crab heart *in vivo*. Its tetanizing effect leads to cardiac tremors and finally to cardiac paralysis.

S. M.

Studies of the course of renal elimination of phenolsulfonephthalein. EGGERT MOELLER AND C. LUNDSGAARD. *Compt. rend. soc. biol.* 92, 1320–1(1925).—A study of the hourly elimination in the urine of phenolsulfonephthalein injected intravenously over a period of 10 hrs. after the injection in normal and in diseased persons reveals that the liver plays an important part in the elimination of the dye.

S. M.

Glycogenolytic action of insulin. E. F. MÜLLER AND WM. F. PETERSEN. *J. Am. Med. Assoc.* 85, 820–3(1925).—Insulin absorbed in the circulation initiates an increase in blood sugar by stimulating the liver to mobilize glucose (glycogenolysis). Increased glucose formation and its appearance in the blood stream after subcutaneous insulin injection can be detd. directly in the period before the hormone action sets in, *i. e.*, in 20 to 40 min. The continuous mobilization of glucose can be detd. by indirect methods, even during the period of hormone action. The reestablishment of the preinsulin level of the blood sugar is probably due to a continued mobilization of glucose. In dehepatized animals, no recovery of sugar values follows after subcutaneous administration. The intracutaneous method of administration of insulin in small amts.

prived of kidney tissue causes a marked shift in the water content and in the chlorides of the tissues and the blood. After an intravenous infusion the blood contains a larger amt. of water, the serum a greater amt. of chlorides. It is thus evident that the hypophysis ext. can cause a hydremia and an increase in blood chlorides through some extrarenal mechanism. Nevertheless, the ext. unquestionably has an effect on the output of urine by the kidneys, for if the ext. is introduced into the arterial blood supply of the left kidney the inhibition (or stimulation) of diuresis occurs on the left side more promptly and to a greater degree than on the right side. An increase in venous pressure is not responsible for the inhibition of diuresis. G. H. SMITH

Clinical value of ephedrine. T. GRIER MILLER. *Am. J. Med. Sci.* 170, 157-81 (1925).—In its general and diastolic physiol. effects ephedrine resembles epinephrine but it differs from the latter in that the effects are more lasting and in that it can be effectively administered by mouth. Oral or subcutaneous administration of doses of 50 to 125 mg. raises the systolic pressures and decreases the pulse rate for several hrs. Heart action is stimulated. Urine output is increased. At times the basal metabolism is increased. Temporary improvement follows its use in a variety of pathol. conditions. Applied locally to mucous membranes it causes a prompt contraction which lasts for 3 hrs. or more, and it is not irritating. G. H. SMITH

Effect of strontium on the heart. K. GRASSHEIM AND G. VON DER WETH. *Arch. ges. Physiol.* (Pflüger's) 209, 70-80 (1925).—In all of its effects upon the normal active frog heart Ca may be replaced by Sr; indeed, a heart whose activity is impaired by a deprivation of Ca is restored more quickly and to a higher degree by Sr than by isotonic Ca. The superiority of Sr is shown by the facts that with Sr the amplitude of the heart is always greater than with Ca; that arrested hearts can be started with Sr when Ca fails to do so; and that disturbances in rhythm can be removed by Sr when Ca is without a comparable effect under the same conditions. With Sr, after a prompt systolic increase, there is a lengthening of the systolic contraction phase, while Ca under the same conditions causes a lengthening of the maximal relaxation during diastole. Sr exerts the same reviving effect after muscular intoxication by chloramine, but after intoxication with chloral hydrate differences in the effect upon the stimulus forming app. can be disclosed, in that Sr reactivates when Ca fails to do so. Sr favors the contraction and also increases the conduction of the heart. Under definite conditions injured hearts may be sensitized to Ca by Sr. The more marked effects of Sr on the heart as compared with those of Ca are due to the fact that Sr becomes fixed to the heart muscle more strongly. G. H. SMITH

I—ZOOLOGY

R. A. GORTNER

Uric acid formation in the crustacean, *Panulirus argus*. SERGIUS MORGULIS. *Proc. Am. Soc. Biol. Chem.*, *J. Biol. Chem.* 63, xviii-xix (1925).—The blood of the crawfish, *Panulirus*, becomes entirely free from uric acid after it has been kept a day or two without food. After intramuscular injection of 1-3 g. urea, the uric acid reaction invariably reappears. Urea given by mouth does not produce this effect; neither does the injection of any one of a number of NH_4 salts, except NH_4 lactate, which some times gives a slight reaction. Glycine gave more frequent positive results, though never so marked as with urea. Both the Benedict direct method and the Morris-Macleod pptn. method were used for the detn. of uric acid and gave essentially the same results. I. GREENWALD

Effect of certain nonelectrolytes on the mucus of frog eggs. L. EMERIQUE. *Compt. rend. soc. biol.* 92, 850-3 (1925).—Sucrose solns. of $\Delta = 0.47$ produce much greater swelling of the mucous membrane of frog eggs than isotonic salt solns. Further expts. with the entire oviduct which is covered with the same mucous material found in the egg membrane give similar results. Thus, in a series of solns. of the same ρ_H (7.0) and $\Delta = 0.45$, the relative swelling of the mucus was in this order: sucrose 194-8, CaCl_2 16.2, KCl 8.9, and NaCl 5.2. Similar results were obtained with other nonelectrolytes such as glucose, mannitol, urea and asparagine. S. MORGULIS

Effect of carbon dioxide on the development of the chick egg. TH. ROGALSKI. *Compt. rend. soc. biol.* 93, 706-8 (1925).— CO_2 inhibits the development of the chick egg and causes lesions which are the more extensive the longer the egg is exposed to the CO_2 and the higher the temp. under which the CO_2 acts. The effects are similar to those produced by X-rays. S. MORGULIS

Comparison of the effects of X-rays and of aging on chick eggs. P. ANCEL AND P. VINTEMBERGER. *Compt. rend. soc. biol.* 92, 1401-3 (1925).—The development of the

radiated chick egg is exactly like that of eggs aged for various lengths of time (11 to 40 days at 10°). It is concluded that X-rays produce rapid transformation in the cells which aging produces only slowly.

S. MORGULIS

Comparative effect of X-rays and of radium on the nucleus and cytoplasm. P. REISS. *Compt. rend. soc. biol.* 92, 1403-6(1925).—The relative sensitivity of cytoplasm and nucleus is 18:1 for Ra and 3.8:1 for X-rays.

S. MORGULIS

Radiosensitivity of dividing cells. P. ANCEL AND P. VINTEMBERGER. *Compt. rend. soc. biol.* 92, 986-8(1925).—In the chick blastoderm the cells during mitosis are no more sensitive towards radiation than during the resting phase.

S. MORGULIS

The nitrogen excretion of *Sepia officinalis*. H. DELAUNAY. *Compt. rend. soc. biol.* 93, 128-9(1925).—The urinary N products are principally in the form of NH_3 or NH_2 compds. The kidney of *Sepia* has a large concg. power, excreting a urine which contains 10 times as much non-protein N as the blood but the const. presence of albumin and the high amino acid content signify a high degree of functional insufficiency in the normal animal.

S. MORGULIS

Factors regulating the coloration of *Leptodactylus ocellatus*. B. A. HOUSSAY AND J. UNGAR. *Compt. rend. soc. biol.* 93, 259-60(1925).—The hypophyseal secretion is the principal factor regulating the coloration of the frog. The adrenals exert no influence.

S. MORGULIS

Effect of the rate of development of radiated eggs of *Rana* on its survival time. P. ANCEL AND P. VINTEMBERGER. *Compt. rend. soc. biol.* 93, 281-3(1925).—When the frog egg receives a lethal dose of X-ray it is only necessary to slow up the rate of its development in order to prolong its survival.

S. MORGULIS

Artificial parthenogenesis. V. Anomalous action of mercuric chloride. L. V. HEILBRUNN. *Biol. Bull. Marine Biol. Lab.* 49, 241-9(1925); cf. C. A. 19, 2090.—Dil. solns. of HgCl_2 in sea water cause typical membrane elevation in the sea urchin egg in spite of the fact that these solns. presumably do not lower surface tension. The action of HgCl_2 is favored by aging the eggs. Eggs fresh from the ovary are not acted upon. The percentage of membrane elevation on treatment with HgCl_2 soln. increases in proportion to the time the eggs have stood in sea water before being subjected to the reagent. The favorable effect of aging is apparently due to the removal of CO_2 . The addn. of CO_2 prevents membrane elevation by HgCl_2 . If eggs are centrifuged 1 or 2 min. after treatment with HgCl_2 is begun, membrane elevation is generally prevented. Solns. of HgCl_2 in contact eggs lose their power of provoking elevation. The last two facts above stated are regarded as evidence in favor of the view that HgCl_2 reacts with the jelly or cortex of the egg to form Cl . Such a reaction is in accord with the usual behavior of HgCl_2 in the presence of org. materials. Cl gas is effective in producing membrane elevation. The action of the HgCl_2 in causing membrane elevation is probably due to the formation of Cl . Since Cl has a very low surface tension, the fact that HgCl_2 causes membranous elevation cannot be used as an argument against the surface tension theory.

L. W. RIGGS

Effect of thyroid feeding on the moulting process and feather structure of the domestic fowl. H. B. TORREY AND BENJAMIN HORNING. *Biol. Bull. Marine Biol. Lab.* 49, 275-86(1925).—Two opposing kinds of results appear from feeding thyroid to chicks. One of these is comparable with the effects of nutritive deficiency. Such effects vary in intensity with the dose of thyroid administered. The second consequence of thyroid feeding, viz., the acceleration of feather differentiation and eruption, appears to involve an acceleration of division processes in the cells of the feather germ.

L. W. RIGGS

Action of certain substances on oxygen consumption. VI. The action of acids. I. H. HYMAN. *Biol. Bull. Marine Biol. Lab.* 49, 288-321(1925).—The effect of acidification of the medium on the rate of O consumption of aquatic organisms was studied with HCl , HNO_3 , H_2SO_4 , H_2CO_3 , AcOH , $\text{HC}_4\text{H}_7\text{O}_2$, $\text{H}_3\text{C}_6\text{H}_5\text{O}_7$ and $\text{H}_2\text{C}_4\text{H}_3\text{O}_6$ in aq. solns. with p_H ranging from 7.5 to 5.0 at intervals of 0.5 p_H . *Planaria dorotocephala* was the animal used in most of the tests. The acidification of natural waters either salt or fresh (p_H 8.0) by any of the acids used except butyric causes a decrease in the rate of O consumption at all acidities greater than p_H 7.0. The majority of acids also causes depression between p_H 7.8 and 7.0, but in the case of AcOH and more doubtfully H_2CO_3 there was some tendency toward a slight acceleration of the rate of O consumption at these lower concns. The decrease in the rate of O consumption is completely and promptly reversible, as long as the animals are not actually injured. The acidification of fresh water from which all carbonates have been removed has no, or only a slight, effect upon the rate of O consumption of *Planaria*, except when the acidity is produced by CO_2 . The depressing action of CO_2 is the same whether the

gas is added to ordinary or to carbonate-free water. Therefore the depressing action of acids is due chiefly or wholly to the CO_2 which they liberate from the carbonates of the waters used. The max. amt. of depression of O consumption that can be induced by acids is about 50%. At the acidity at which max. depression occurs, the CO_2 content is about 3%. Concentrating the CO_2 beyond 3% does not increase the depression. Butyric acid has almost no action upon O consumption of *Planaria*. No explanation has been discovered for this fact. The order of toxicity and the H-ion concns. at which acids are equally lethal are: butyric p_H 5.0, AcOH 4.4, $\text{H}_2\text{C}_4\text{H}_4\text{O}_6$ 3.6, citric 3.4, H_2SO_4 3.2, HNO_3 and HCl 3.0. The H ion is not the cause of death but either the anion or the mol. of the acid is involved. Penetrability is probably also a factor. Death in acids appears to be due to coagulation. The order of toxicity of the acids and the p_H at which they are equally lethal are the same in ordinary and in carbonate-free water, showing that death is not due to CO_2 liberated. These expts. cast a doubt on the supposed importance of H-ion concn. *per se* in biological processes.

L. W. RIGGS

Amount of carbon dioxide given off by eggs during incubation. H. ATWOOD West Virginia Agr. Expt. Sta., *Bull.* **185**, 15 pp. (1924).—The amt. of CO_2 thrown off by eggs during the incubation process is relatively small during the first half of the hatch, but increases rapidly during the last half of the period.

J. J. SKINNER

Growth, development and metabolism of frog larvae under different nutritional conditions. FRANZ GROEBBELS. *Arch. ges. Physiol.* (Pflüger's) **208**, 718–29 (1925).—Frog larvae fed upon autoclaved piscidin or autoclaved yeast show, in comparison with larvae fed upon unheated substances, a stimulation of the growth rate, an accelerated development, and they attain a premature high level of dry residue showing an increased abs. and relative O utilization. This stimulation is due to the fact that in the heating of the foodstuffs sugar is formed. Larvae fed upon thymus substance have a higher dry residue and a greater abs. and relative O use than those fed upon piscidin. The effects of starvation upon the loss in body wt. and in the capacity of the larvae to regain wt. and to effect continued growth depends largely upon their size at the time starvation is commenced. After a hunger period of 8 days the O utilization falls to about $1/4$ of that of control larvae and then it increases somewhat for a time only to fall sharply just before death. In the course of natural development the O utilization increases greatly just prior to metamorphosis, and the amt. of dry substance as well as the relative O utilization is related to the time at which the metamorphosis occurs. Cf. *C. A.* **18**, 1517.

G. H. S.

12—FOODS

W. D. BIGELOW AND A. E. STEVENSON

Use of preservatives and artificial colors in food. OSMAN JONES. *Ind. Chemist* **1**, 119–21 (1925).—The need of food preservatives other than salt, sugar and vinegar is discussed with special reference to the use of B compds., SO_2 in various forms, benzoic and salicylic acids and their salts. Certain fruits contain one of these acids or its derivatives which must be considered in detg. the amt. of permissible added preservative. SO_2 is used in certain stages of manuf. to prevent decomposition and is not always completely removed. Instead of prescribing a list of permissible colors, the English Draft Regulations give a short list of substances which may not be used. In view of the drastic restrictions proposed by the Ministry of Health, the question is raised as to whether the public would not be exposed to a greater risk by the consumption of food which is not quite fresh, than by eating fresh food contg. a small quantity of preservative.

L. W. RIGGS

Variation in calcium content of common foods. MARGARET FRANK AND CHIEH WANG. *J. Home Econ.* **17**, 494–7 (1925).—Ca detns. in 8 foods (bread, farina, carrots, orange, potato, milk, egg and meat) covering a year indicate considerable variation in Ca content at different times. Ca metabolism studies should be accompanied by Ca detns. of the foods used.

L. D. ELLIOT

A colloidal investigation of fat determination in milk. New methods for accurate fat determination in milk. J. GROSSFELD. *Z. Nahr. Genussm.* **49**, 313–31 (1925), cf. *C. A.* **19**, 2855.—The shaking out of milk fat by fat solvents is hindered by the colloidal milk protein. The difficulties encountered with previous methods of fat detn. are due chiefly to incomplete removal of the colloidal protein. The colloidal protein may be peptized by strong HCl, which, however, tends on heating to caramelize the lactose, thus causing a source of error. G. avoids this difficulty by gently boiling

for 10 min. under a reflux condenser a mixt. of 50 cc. of milk, 100 cc. of concd. HCl and 100 cc. of trichloroethylene, thus carrying out the decompn. of protein by HCl and the extn. of fat by trichloroethylene in one operation. At this temp. caramelization does not occur. This method gives the milk fat plus the fatty acids liberated by hydrolysis of lecithin. The results are 0.05% higher than those with the Rose-Gottlieb method. Another method, based on coagulation of the milk protein, is as follows: 50 cc. of milk is dild. with 150 cc. of water and treated with 10 cc. of a CuSO_4 soln. (69 g. of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in 1 l.). After 10 min. or more, the ppt. is removed by filtration, dried and the fat extd. by (a) heating for 5–10 min. with 100 cc. of trichloroethylene under a reflux condenser, or (b) extg. for 6 hrs. with ether in a Soxhlet app.; (a) and (b) yield identical results. The coagulation method gives results 0.02% higher than those by the Rösse-Gottlieb method, the same quantities of milk being used. With increasing amts. of milk, the results by the coagulation method tend to be low. WILLIAM J. HUSA

The chlorine-lactose number and chlorine determination in milk. J. DROST. *Z. Nahr. Genussm.* **49**, 332–42 (1925); cf. *C. A.* **17**, 3382; **18**, 2925.—A low refraction and a high Cl content indicate an abnormal milk such as colostrum. A low refraction and a low Cl content arouse suspicion of previous dilution. Detn. of Cl in milk ash gives low results as compared with direct titration, which D. carries out as follows: 10 cc. of milk is treated with 5 cc. of HNO_3 (d. 1.165), 10 cc. 0.1 *N* AgNO_3 soln. is added and the excess AgNO_3 detd. by titration with NH_4CNS soln. with ferric alum as indicator. D. replies to criticisms of Nottbohm (*C. A.* **19**, 1604). W. J. H.

Some physico-chemical constants of fresh milk and milk pasteurized by different methods. G. ACHARD AND H. STASSANO. *Compt. rend. soc. biol.* **93**, 708–10 (1925).—The only difference between fresh and pasteurized milk is in regard to its viscosity and ρ_{40} , otherwise the alterations are insignificant. S. MORGULIS

Changes in the chemical equilibrium of milk due to heating in vacuo (pasteurization). HENRI STASSANO AND A. P. ROLLET. *Compt. rend. soc. biol.* **93**, 718–20 (1925). S. M.

Insufficiency of the milk of pregnant cows for nursing infants. ED. CROUZEL. *Repert. pharm.* **36**, 260–1 (1925).—The abnormal compn. of such milk is emphasized, notably the lack of certain mineral salts and casein. W. O. E.

Determination of the fat in milk. EMM. POZZI-ESCOT. *Ann. chim. anal. chim. appl.* **7**, 257 (1925).—In France the Gerber method is often used for the detn. of fat in milk and it is sometimes assumed that the readings give the % fat in 0.11 but the tubes are usually calibrated to give the % fat in 100 g. of milk, as in the rather more satisfactory Babcock method. W. T. H.

Reducing the stability of butterfat emulsions. H. A. RUEHE AND B. A. STIRITZ. *J. Dairy Sci.* **8**, 330–43 (1925).—A considerable amt. of butterfat is retained in the buttermilk. The authors have attempted to reduce this loss by breaking down the emulsion of the fat by the addition of HCl, NaCl, Na_2HPO_4 , sodium citrate and $\text{Ti}(\text{NO}_3)_4$. The av. whey content of 79 samples of buttermilk was 82.5%. The fat is held partly in the curd and partly in the whey, the relative amts. being dependent on the condition of the cream and several other factors. Addition of 1% of NaCl to the cream before churning tends to decrease the fat loss, but HCl is more effective and does not increase the acidity of the butter. A combination of both is more effective than either of these when used alone. It was not possible to reduce the loss below approx. 0.5%. The use of the other chemicals mentioned did not prove effective. J. C. J.

The rational grinding of maize. D. MAROTTA AND F. DI STEFANO. *Ann. chim. applicata* **15**, 227–33 (1925).—An illustrated description of a new type of machine for grinding maize, which is of the rolling mill type used on an industrial scale, but is smaller and is economical for small scale use. Unlike some previous processes it yields *degerminated flour*, bran and germ as sep. products. The grain after passing through a magnetized system to remove stray bits of Fe is fed through 2 sets of differential corrugated rolls, is then fractionally bolted, which seps. all germ, the residue is remilled and is bolted again to a finer degree, which seps. flour and bran. Analyses show that flour prepd. by this process contains less ash, cellulose and fat and has a lower acidity than that prepd. by small scale millstone methods. It also has better keeping qualities than millstone flour on account of the germ having been removed. The latter after removal serves as a source of oil and of fodder cake. C. C. DAVIS

Fermentation of chestnuts in the shucks. Their mechanical shelling. G. LO PRIORE. *Sluz. sper. agrar. ital.* **57**, 394–9 (1924).—The fermented chestnuts weigh more than non-fermented ones. The shells in proportion, however, weigh less. Shells from non-fermented nuts analyze 9.20% tannins, 4.15 sol. non-tannins, 64.59 insol. substances and 22.06 moisture; from fermented nuts 7.87% tannins, 3.49 sol. non-tannins, 72.38 insol. substances and 16.26 moisture. ALBERT R. MERZ

• **Intoxication of animals due to damaged potatoes.** RENÉ BISSAUGE. *Thesis*, Paris 1925; *Bull. soc. hyg. aliment.* 13, 403-4(1925).—Troubles experienced when livestock are fed frozen potatoes are attributable to the increase in the solanine content of the potatoes. Green and germinating potatoes are also liable to cause trouble, because the green portions and the germs have high solanine contents. When potatoes (either sound or damaged) are boiled with the peel, the water should be discarded, as it dissolves a considerable amount of solanine. Livestock fed an excessive proportion of beet or potato pulp (from distilleries) suffers from osteomalacia. This is not due to a specific action of the pulps, but to their deficiency of Ca salts. Children should not be given milk from cattle fed on these pulps. Solanine is less toxic when taken *per os* than by hypodermic injection, and elimination in the urine is fairly rapid. The most efficient antidote is tannin, either pure or as oak or chestnut bark ext. Similar accidents are observed with man, but less frequently.

Toxicity of potatoes with high solanine content. R. WEIL. *Pharm. Zig.* 70, 1145-6(1925).—Referring to a recent paper by Sabalitschka and Jungermann (C. A. 19, 1469) on the solanine content of potatoes, it is shown that the repeated cases of poisoning observed among soldiers have been caused by solanine which is produced by 2 well defined bacteria, *B. solaniferum non colerabile* and *B. solaniferum colerabile*.

Fumigation injury of watermelons. G. B. RAMSEY. *Phytopathology* 15, 479-81 (1925).—Fumigation of watermelons in cars with formaldehyde by the standard method adopted for the control of hoof and mouth disease produces severe blistering and pitting of the surface, resembling anthracnose. Not all fumigated cars show injury, indicating that the handling of the fruit prior to shipment may det. its susceptibility to injury by formaldehyde.

Protein substitution by NH_4 salts and amino substances for animal nutrition (SCHARER, STROBEL) 11E. Apparatus for spray desiccation of milk (U. S. pat. 1,554,330) 1. Utilizing residual waters from pressing beetroot [as stock feed] (U. S. pat. 1,552,737) 28.

• MONVOISIN, A.: *Le lait et les produits dérivés*. 3rd ed. Vol I. Paris: Vigot. 470 pp. Reviewed in *Bull. soc. hyg. aliment.* 13, 408-9(1925).

Whole milk powder. B. D. WHITE. U. S. 1,554,151, Sept. 15. Cream is sepd. from milk and converted into butter. The butter is heated to 65-120° to volatilize the constituents which cause rancidity, and the resulting butter oil is emulsified or homogenized with the milk from which it was sepd., the mixt. being desiccated to produce a powder.

Butter. H. HEUSER. U. S. 1,550,358, Aug. 18. Butter is mixed with about 1/4-1% of Na hypophosphite and heated in a sealed container to about 68°, cooled, and agitated during both the heating and cooling, to improve its keeping properties.

Preventing rancidity of cooked cereal foods. J. P. TRICKEY. U. S. 1,555,170, Sept. 29. Fine dusty particles (which tend to promote rancidification) are removed.

Puffing cereals, potatoes, bananas or other starchy food products. ANDERSON PUFFED RICE Co. Brit. 232,543, Apr. 21, 1924. Special features of heating under pressure followed by expansion by sudden release of pressure are described.

Shortening for food products. J. C. BAKER. U. S. 1,553,294, Sept. 8. A fluid shortening mixt. comprizes 45-60% of lard, hydrogenated cottonseed oil or other suitable edible fat emulsified in H_2O with Na stearate and stearic acid in proportions which render the emulsion permanent.

Canned cooked cheese. C. L. ARNOLDI. U. S. 1,552,977, Sept. 8. Curds are heated in their own liquid until completely dissolved, the heated liquid is poured into cans, the latter are sealed, while the contents are hot, and the sealed cans of cheese are sterilized at about 117° and then immediately chilled.

• **Apparatus for sterilizing foods, etc.** H. INGRAM. Brit. 231,961, Jan. 21, 1924.

• **Candied fruits.** W. K. NICHOLS and E. P. NICHOLS. U. S. 1,550,321, Aug. 18. Mech. features of pasteurizing fruit, impregnating it with sirup and draining and drying it.

Preventing fermentation of fruit products. R. F. BACON. U. S. 1,553,496, Sept. 15. A small proportion of CHCl_3 (usually about 1/2-1% with fruit juices) is added to juices, pulps or other fruit products which are confined in a hermetically sealed receptacle so that the space not filled by the fruit product itself is filled with CHCl_3 vapor.

Bread. H. HEWITT AND BRITISH ARKADY CO., LTD. Brit. 232,284, Dec. 12, 1923. Ca lactate or Mg lactate 1-2 oz. is added to each 280 lbs. of flour in making bread.

Bread. THE FLEISCHMANN COMPANY. Brit. 213,522, March 28, 1923. In straight-dough bread manuf., somewhat more yeast than usual is employed and higher mixing and proofing temps. Temps. between 29° and 38° are indicated and proofing times from zero to 2 hrs. Brit. 226,308 specifies a similar process in which the divided dough is proofed at a temp. of about 42-46°.

Stabilizing near beer, milk, fruit juices and similar beverages. H. HEUSER. U. S. 1,550,359, Aug. 18. A phosphite compd. such as Na hypophosphite is added.

Cattle and poultry food from fish refuse. J. LEWIS. U. S. 1,550,035, Aug. 18. See Brit. 214,828 (C. 4, 18, 2774).

Preparing cottonseed meal for use as a food. D. F. SAWYER. U. S. 1,553,634, Sept. 15. In order to render cottonseed meal non-toxic and adapted for feeding live stock it is mixed with about $\frac{1}{3}$ its dry wt. of H₂O to render the meal porous and spongy, then heated until it assumes a dark color, and dried to a moisture content of about 10%.

Stock food. W. P. M. GRELCK. U. S. 1,555,246, Sept. 29. Milk in which lactic acid has been developed is used for steeping grain hulls, e. g., "shorts" of wheat. The product is ground to a cream-like paste, incorporated with additional milk contg. lactic acid, and the H₂O in the mixt. is partially removed.

Preserved stock feed. W. P. M. GRELCK. U. S. 1,554,913, Sept. 22. A semi-liquid feed contg. fresh malted grain as its principal constituent, including the fresh sprouts, is impregnated with 4-6% of lactic acid.

Preserving fodder, etc. O. MEYER-KELLER ET CIE. Brit. 232,075, June 18, 1924. Wire ropes or other elec. conductors are embedded directly in green fodder or similar material in a silo, and the material is heated by passing a current of 10-25 v. through these conductors. The latter may be withdrawn when the treatment is complete.

13—GENERAL INDUSTRIAL CHEMISTRY

HARLAN S. MINER

The chemical exposition at Turin. H. GROSSMANN. *Chem.-Ztg.* 49, 748-9 (1925).—Following the plan of the Chemical Exposition held in New York, a similar exposition was opened in Turin, Italy, in May, 1925. Some 29 groups of industries were exhibitors. Descriptions, interpretations of significant features of the exhibits, and production statistics are presented.

Solving heat transfer problems graphically. J. A. POTTER, JR. *Chem. Met. Eng.* 32, 690-1 (1925).—A graphic soln. is presented for the equation $u = 1/(1/u_1 + 1/u_2 + 1/u_3 \dots)$. Lay off two equal scales at right angles (scales *a* and *b*) and draw a line from the origin at 45°. Take u_1 on scale *a*, u_2 on scale *b*, join them, and where the line joining them cuts the 45° line project across to either *a* or *b* and read u . If there are only 2 terms, this is the soln. If there are 3 terms, join this value of u on scale *a* to u_3 on scale *b*, and again read the result from the intersection with the diagonal. This may be repeated for as many terms as desired.

Harmful dusts, gases and fumes are industrial menaces. JOHN ROACH. *Nation's Health* 7, 609-11 (1925).—Discussion by the Deputy Commissioner of sections of the New Jersey labor laws which are of especial interest to the chemical industries.

Compressed and liquefied gases in the war. R. LEPSIUS. *Z. kompr. u. flüssige Gase* 21, 1-7, 17-9, 45-48, 37-61, 59-72 (1925).—Review of use of compressed O, H, N, air, and illuminating gas and of liquefied O, C₂H₂, CO₂, SO₂ and Cl in the World War.

New methods of gas washing. I. The tetralin method. G. WEISSENBERGER. *Glückauf* 61, 426-30 (1925); cf. following abstr.—The advantages of using tetralin for the washing of gases in the oil and coking industries are dealt with. OSCAR PAUF.

New methods of gas washing. III. Experiments with combined absorption materials. G. WEISSENBERGER AND F. SCHUSTER. *Z. angew. Chem.* 38, 626-9 (1925); cf. C. A. 19, 2267 and preceding abstr.—Of cyclohexanol and its *o*-, *m*- and *p*-Me deriv., the *o*- is the best solvent for β -naphthol, and *m*- for α -naphthol. Mixed β -naphthol and methylcyclohexanol in the proportion of 1:3 was a better solvent for acetone and Et₂O than a 1:4 mixt. Tetrahydronaphthalene and phenol in the ratio of 9:1 was a better solvent for petr. ether than 4:1 or 7:3. Gas-oil was a better solvent for petr.

ether and benzene than spindle oil or tetralin. For benzene, tetralin was a better solvent than *m*-cresol or wash-oil. Vapor pressures of different ratios are given.

C. G. KING

Modern stationary extraction plants. BRUNO HASSEL. *Chem.-Ztg.* **49**, 721-3 (1925).—A general discussion of app. and methods of operation of present day extn. plants, especially with reference to the winning of oil from vegetable products. Cf. C. A. **18**, 2268.

W. C. EBAUGH

Shop and factory hygiene (WOLFF) **14**.

W. STENDER: **Die Wärmeübergang an strömendes Wasser, in vertikalen Rohren.** Berlin, 1924: Julius Springer. 86 pp. 25 illus. Price, G. M. 5.10. Reviewed in *Gesundh. Ing.* **47**, 134 (1924).

Controlling chemical reactions by concentration and temperature regulation. M. BRUTZKUS. *Brit* **231**, 224, Dec. 17, 1923. In various reactions, reagents or solvents are continuously introduced into the reacting materials to compensate for differences which the desired reaction tends to induce and the temp. is controlled, e. g., by heating and cooling coils immersed in the materials in the reaction zone. Manuf. of K_2SO_4 (from KCl and $MgSO_4$), EtOAc (from HOAc and EtOH), and HOAc and EtOH (from EtOAc) are described.

Separating colloids from liquids by flotation. K. YAMASHITA. *Brit.* **231**, 430, March 29, 1924. Colloids dissolved or suspended in liquids are sepd. by adding flotation agents such as oils, creosote or coal tar and adding or producing a gas to effect flotation. Treatments of sugar juices, serums, waste liquors contg. fatty acids, and beer are referred to.

Distilling mineral oils, tars, fatty acids, etc. C. H. BORRMANN. *Brit* **231**, 686, May 2, 1924. The crude material to be distd. is passed successively through tubular heaters at successively higher temps. and through intervening vapor separators.

Electric insulation. D. M. SUTHERLAND, JR. U. S. **1,554,895**, Sept. 22. Insulation in sheets or other form is made from a pulped compn. comprizing cellulose and gilsonite or other suitable binder.

Electric insulators. A. BÜLTEMANN. U. S. **1,555,940**, Oct. 6. The several parts of composite insulators are cemented together with a hydraulic binder, e. g., port. cement, to which has been added pitch, S, resin and alc. or oil or other solvent and H_2O -repelling substances.

Heat-insulating compositions. W. B. SEMPLE and J. GARLAND. *Brit.* **232**, 341, Jan. 21, 1924. A heat-insulating and fire-resisting material is prepd. by heating fully hydrated pptd. $CaSO_4$ in H_2O and evapg. or decanting the excess H_2O to leave a plastic spongy mass. Various other ingredients may be added, e. g., paper, jute or rag pulp, lime, NaCl, wood ash, infusorial earth, silica, plaster of Paris, Na silicate, cork, wood pulp or asbestos.

14—WATER, SEWAGE AND SANITATION

EDWARD BARTOW

The control of sea water flowing into the Lake Washington ship canal. E. VICTOR SMITH AND T. G. THOMPSON. *Ind. Eng. Chem.* **17**, 1084-7 (1925).—To prevent contamination of Lake Washington by sea water entering through the ship canal completed in 1916, due to the tendency of the salt water to "climb" into the fresh water body, a drain was provided from the lower end of the salt water basin above the locks to an opening at a level 4 ft. below that of high tide. This gives a max. head of 11 ft. for forcing the waters through the drain from the bottom of the basin. Investigations of the salinity of water collected at various points in the system have been continued since 1917, and results show that (a) the concn. of sea water in the canal is dependent upon the amt. of rainfall, no. of lockages, proper functioning of the salt water drain and the method of disposal of the surplus water; (b) if surplus waters are conducted as much as possible through the lock valves the degree of salinity can be maintained at a min. far lower than if the surplus be permitted to run wholly over the spillways; (c) storage of some of the surplus water of winter and spring season, to be used for drainage through the lock valves during the dry months, would aid in decreasing the salinity of the canal system.

W. C. EBAUGH

The spa treatments at the medical baths, Tarquay. J. M. SCOTT. *J. Roy. San*

Inst. 46, 21-2(1925).—Since 1914 the equipment has been rebuilt and improved. New forms of treatment have been added. R. E. GREENFIELD

The chemical determination of fecal matter in water. W. AUSTEN. *Wasser u. Gas* 15, 484-92(1925).—A no. of tests on various waters indicate Jolles' method for the detn. of urine in water, to be uniformly successful. The method used is as follows: Add 1 cc. of a 5% alc. soln. of thymol to 10 cc. of the water to be tested. Shake, add 10 cc. of fuming HCl (sp. gr. 1.19) contg. 5 g. Fe chloride per l. Allow to stand 5 min., add 4 cc. of CHCl_3 and shake again. The presence of a violet color indicates the presence of urine in the water. A. found the reaction was not hindered by Cl, or NO_3 , but was hindered by NO_2 . This is overcome by the addn. of Mohr's salt. This test also cannot be used on filtered water, filtering removing the indican, the substance in urine upon which this test is based. This test is sensitive in a diln. of 1:100. A modification of Winkler's method for protein NH_3 is also given. MARTIN E. FLENTJE

Importance of differentiating the colon-aerogenes group in examining water. J. J. HINMAN, JR. *Am. J. Public Health* 15, 614-9(1925).—The detection of the colon-aerogenes group is a most important part of water lab. procedure. In well supplies or supplies supposed to be free from surface wash, the presence of any lactose fermenter, even a spore former, is objectionable. In purified surface waters the presence of the members of the colon-aerogenes group is permissible to the limit of the Treasury Dept. standards, unless those present belong to the coli section of the group in which case an adverse report should be given. EDWARD BARTOW

Studies on water purification. I. Adsorption of acids and alkalies by Kambara earth. SHU OIKAWA. *J. Biochem. (Japan)* 5, 49-55(1925).—Adsorption of acids and alkali from solns. is affected most within the first 5 min. of shaking with the Kambara earth. Further shaking has practically no influence. It is very probable that its adsorbing power depends upon the presence of colloidal silicic acid and of humus colloids. S. MORGULIS

Modern British practice in water softening. III. Lime cream and soda ash plants. D. BROWNLEE. *Ind. Chemist* 1, 386-92(1925); cf. *C. A.* 19, 2858. E. J. C.

The prevention of boiler scale formation in steam boilers. HELLMERS Z. *angew. Chem.* 38, 609-10(1925).—Pptn. of boiler scale from both temporary and permanent hardness is lessened by a 0.1% tannin soln. The ppt. formed with tannin present can be redissolved by excessive washing, and is in a soft, loose form. C. G. K.

Feed water purification. J. NEIDE. *Gesundh. Ing.* 47, 570-1(1924).—Carbonate scale, because of its porosity, is a poorer heat conductor than sulfate scale, with its cryst. structure. Complete pptn. of the carbonates, rather than of the sulfate, should be aimed at in feed water purification. Dissolved gases, especially O_2 , cause corrosion and blisters and should be removed. MARTIN E. FLENTJE

Coagulation processes during the purification of river water. C. P. MOM. *Mededel. Burgerlijken Geneeskund. Nederland-Indie* Part 1, 27-71(1925).—This is a detailed study of the occurrence and compn. of colloidal clay in the water of the Tjiliwong River and the coagulation of this clay by means of $\text{Al}_2(\text{SO}_4)_3$. A dose of 15 mg. of $\text{Al}_2(\text{SO}_4)_3$ per l. of river water was sufficient to cause coagulation, and the most favorable reaction was about p_{H} 5.5 to 6.0. The colloidal Al_2O_3 is the coagulative factor proper, the H and Al ions supporting the process. The Al_2O_3 has but a weak discharging power, and its effect has to be ascribed to its strong flocculating or coalescing power. G. F. R.

The iron removal plant of Löbau. F. H. SCHILLING. *Der Strassenbau* 11, 91-3(1924); *Gesundh. Ing.* 47, 352(1924).—A description of the Fe removal plant of Löbau. MARTIN E. FLENTJE

Color and other phenomena of water from an unstripped reservoir in New England. C. M. SAVILLE. *J. New Eng. Waterworks Assoc.* 39, 145-70(1925).—A rather complete report on the variation in color for several years in the water of the several reservoirs which make up the Hartford (Conn.) supply. In a new unstripped reservoir the color of the water will be greater in the reservoir than that of the inflowing streams. After a period of 3-10 years the color of the water will be less than that of the inflowing water. A discussion of the paper by other experts accompanies the article. R. E. G.

Influence of curvature on air saturation of water and its relation to the air-binding of filters. J. R. BAYLIS. *Ind. Eng. Chem.* 17, 974-9(1925).—The soly. of air, and probably of other gases, varies with the curvature of the gas-water surface. Concave surfaces increase and convex surfaces apparently decrease the satn. point. A much greater concn. of dissolved air is necessary to start bubble formation against solid surfaces than is necessary to cause very small bubbles to increase in size. The release of air in filter beds is always started by air being carried into the bed, or by air not driven out in washing. J. M. HOLDERBY

Water treatment on the Island of Jersey. WILFRED RUSHTON. *Surveyor* 66, 467-8, 513-4(1924); cf. *C. A.* 19, 1171.—Treatment of reservoir by Cu sulfate applied with a sprayer successfully killed undesirable algae without affecting fish life. Rearing of fish in filter beds is advocated. R. E. GREENFIELD

Iron deposit in cast iron pipe. J. R. FOX. *Surveyor* 66, 465-6, 491-2, 509-10 (1924); cf. *C. A.* 19, 1171.—Use of lime, sodium silicate, scraping, etc., to prevent "furring" of pipes by iron bacteria is discussed. The best remedy is considered to be iron removal. The paper is discussed by other experts. R. E. GREENFIELD

Municipal water supply problems of Atlanta, Georgia. P. H. NORCROSS. *Proc. Am. Soc. Civil Eng.* 51, 969-98(1925).—Water from the Chattahoochee River is pumped into settling basins, is treated with alum and lime, resettled and filtered on gravity filters. The new water-works are described. J. M. HOLDERBY

The injuriousness of *Dreissensia polymorpha* Pallas to water plants. F. ROCH. *Gesundh. Ing.* 48, 97-8(1925).—R. describes the mussel *Dreissensia polymorpha* Pallas, and the danger of its presence to water plants. Chlorination is probably the best means of eradication. A bibliography is given. MARTIN E. FLENTJE

Filtration for swimming baths. ANON. *J. Roy. San. Inst.* 46, 47-52(1925).—Filtration of "swimming bath" water results in clearer water and in a saving in fuel, water cost, attendants, wages, etc. R. E. GREENFIELD

The protection of underground water supplies. A. B. CATHCART. *Surveyor* 66, 5-6(1924).—A discussion of lack of legal remedies in pollution of underground water supplies. R. E. GREENFIELD

Modern methods of sewage purification; precipitation and filtration. THOMAS CALBERT. *Surveyor* 68, 219-20(1925).—A description of the settling tanks and sewage-handling devices used in the sewage disposal plant of Howich (Scotland). R. E. G.

Control of odors from sewage-treatment plants. J. F. SKINNER. *Proc. Am. Soc. Civil Eng.* 51, 1182-92(1925); cf. *C. A.* 19, 2097.—A discussion. J. M. H.

The Hoffmann system of sewage purification. KEPNER. *Gesundh. Ing.* 47, 590(1924).—A sepn. of solid and fluid matter is effected by means of a spiral, opening into a constricted conduit. A sludge, usable as fertilizer, is obtained. M. E. F.

Memorandum regarding the utilization of sea water as the transportation medium in a sewerage installation. A. GORDON GUTTERIDGE. *J. Roy. San. Inst.* 46, 42-6 (1925).—Where sea water is used for sewage transportation the following difficulties, none unsurmountable, are encountered: (1) increased corrosion of metal fixtures, (2) decreased carrying power due either to greater penetration of the solids or the result of chem. action making the solids settle more readily, (3) greater pptn. of grease or other substance causing clogging of sewers, decreased biological activity in purification processes. R. E. GREENFIELD

Two-story vs. separated sewage purification tanks. IMHOFF. *Techn. Gemeindeblatt* No. 13, 151-5(1924); *Gesundh. Ing.* 47, 582(1924).—I. discusses the relative merits of the 2 compartment and sepd. settling and digestion tanks. M. E. F.

Factors influencing the bacterial flora of an Imhoff tank. MARGARET HOTCHKISS. *Am. J. Pub. Health* 15, 702-4(1925); cf. *C. A.* 19, 552.—A study of the growth curves for different groups of bacteria suggests that the predominance of any group may depend upon the phase of digestion within the tanks. Variations in the manner in which the tanks are operated influence the general bacterial flora, and tend to obscure any possible seasonal variation. J. M. HOLDERBY

The activated sludge system of sewage purification. O. KAMMANN. *Techn. Gemeindeblatt* No. 1-2, 13-6(1924); *Gesundh. Ing.* 47, 353(1924).—A review of Am and English experiences with activated sludge. MARTIN E. FLENTJE

Sewage purification by means of activated sludge. IMHOFF. *Techn. Gemeindeblatt* No. 11-12, 132-6(1924); *Gesundh. Ing.* 47, 582(1924).—A review of sewage purification by means of activated sludge in U. S. and England. M. E. F.

The activated sludge process. ANON. *Surveyor* 66, 24-31, 59-61(1924).—Report of papers and discussions presented at the International Conference of Sanitary Engineering. R. E. GREENFIELD

Elasticity of activated sludge process. JOSHUA BOLTON. *Surveyor* 66, 85-6 (1924); cf. *C. A.* 19, 2252.—Very successful purification by means of a "simplex" aerator was obtained even when the practice of shutting off part of the aerators at night was adopted. R. E. GREENFIELD

Purification of cesspool sewage. ANON. *Surveyor* 66, 78(1924).—Septic sewage from cesspools is successfully purified without odor by coarse screening, aeration by means of a special atomizer followed by sedimentation. The sludge is disposed of by digestion and clinker filtration. R. E. GREENFIELD

Sewage purification at Manchester. ANON. *Surveyor* 66, 343-4(1924).—Report on exptl plant with chemical analysis. R. E. GREENFIELD

Elimination of odors from garbage disposal works. S. A. GREELEY. *Proc. Am. Soc. Civil Eng.* 51, 1177-81(1925); cf. *C. A.* 19, 2097.—A discussion. J. M. H.

Mites and occupational disease. A. G. G. THOMPSON. *J. State Med.* 33, 419 (1925).—A discussion of mites and the itches caused by them, especially those connected with the handling of grains, vanilla, copra and transmission from other animals. JACK J. HINMAN, JR.

The spread of dysentery considered from the aspect of public health. PHILIP MANSON-BAHR. *J. State Med.* 33, 401-14(1925).—Flies, water and carriers are considered as vectors of infection. Emphasis is placed on carriers in case of bacillary dysentery and on water in case of amebic dysentery. JACK J. HINMAN, JR.

Shop and factory hygiene. GEORG. WOLFF. *Chem.-Ztg.* 49, 745-7(1925).—An essay outlining the advantages of modern factory control in matters of hygiene, workmen's disability compensation, insurance, state inspection, disposal of waste, smoke abatement, sanitary disposal of gaseous and liquid matter, fire protection, lighting, heating, ventilation, wash rooms and toilets. W. C. EBAUGH

Stream pollution by wastes from by-product coke ovens (LEITCH) 21. **Experimental sprinkling of farm land with Dresden sewage** (FLECK, HEILMANN) 15. **Action of water upon Cu pipes** (TAKESH) 9.

FRANCÉ, R. H.: *Wege zur Natur. Eine Einführung in die Untersuchung der Kleinwelt des Wassers und des Bodens.* (Handbücher für die praktische naturwissenschaftliche Arbeit. Band IV.) Stuttgart: Franckhsche Verlagsbuchhandlung. 47 pp. Reviewed in *Gesundh. Ing.* 47, 548(1924).

Purifying water, etc. K. MORAWE. *Brit.* 231,456, March 25, 1924. In treating H₂O or other liquids by the base-exchange process, the exchange operation is interrupted before the exchange substance is exhausted or the regeneration operation is interrupted before the material is completely regenerated.

Softening water. A. R. BURNETTE. U. S. 1,553,067, Sept. 8. The water is first delivered to a conduit at high pressure, taken from the conduit and heated to the b. p. under that pressure, filtered while still under high pressure and then passed in heat-interchange with water flowing to the app. for softening treatment.

Apparatus for softening water with zeolitic material. W. J. HUGHES. *Brit.* 231,818, April 4, 1924.

Apparatus for softening water with zeolitic material. C. H. NORDELL. *Brit.* 231,817, April 4, 1924.

Deaerating water by successive vacuum treatments. G. H. GIBSON. U. S. 1,556,098, Oct. 6.

Driving air from water by use of carbon dioxide. T. HILL. *Brit.* 231,576, Jan. 1, 1924.

Water-filtering plant. L. RYAN. U. S. 1,554,129, Sept. 15.

Hydrocyanic acid for fumigation. CHEMISCHE FABRIK H. STOLTZENBERG. *Brit.* 231,497, March 27, 1924. HCN for destroying vermin is liberated by the action of H₂O on FeCl₃·2HCN, AlCl₃·2HCN or other similar double compds. of anhyd. HCN with chlorides such as those of Sn and Ti.

15—SOILS, FERTILIZERS AND AGRICULTURAL POISONS

J. J. SKINNER

Soils of Brazos, Camp, Ellis, and Washington counties. G. S. FRAPS. Texas Agr. Expt. Sta., *Bull.* 316, 88 pp.(1924). J. J. SKINNER

The solid acidity of the soil. A. DE DOMINICIS AND S. DOJMI. *Ann. chim. applicata* 15, 183-206(1925); cf. *C. A.* 19, 2542.—Systematic expts. were carried out on a no. of soils in the attempt to explain more fully the acidity of soil. Of the soils tested, only one was acid to litmus and none liberated HOAc from Ca(OAc)₂, even after washing with H₂O. To remove bases and carbonates the soils were extd. with dil. HCl, washed, dried at 105-10° and calcined, as a result of which all samples gave an acid reaction with litmus. They were then treated with Ca(OAc)₂ soln. and the free HOAc in the filtrate detd. Dil. HCl dissolved not only carbonates but also certain bases

in the soil, after which treatment the soils rendered salt solns. acid by reappropriating their basic constituents (cations). The action of the HCl was the same regardless of its concn. Provided that it is deficient in Ca compds. a soil can thus become acid through the fixation of the cation of an electrolyte. The addn. of CaCO_3 to soils exhd. with HCl and then treated with Ca(OAc)_2 and washed inhibited the dissociation and removal of bases on subsequent prolonged washing with H_2O . The expts. indicate that there are 2 types of basic constituents in soils, *mobile bases* and *fixed bases*. *Mobile bases* for the greater part are bound to colloids in the soil on which they are adsorbed in amts. which vary continuously, the force of this adsorption differing from ordinary chem. affinity. *Fixed bases* comprise the basic component of the mols. of the cryst. and colloidal compds. of the soil, are present in const. and definite proportions and cannot be sepd. without profound chem. and structural alteration of the soil. When added to a soil in which the mobile bases are deficient or absent, Ca compds. do not improve the condition of the soil by neutralizing its acidity but improve it by virtue of their power as electrolytes of coagulating the colloids from their state of dispersion and rendering them immobile and incapable of being washed away. A crit. review and discussion of past exptl. and theoretical work on the acidity of the soil are included, with 44 references.

C. C. DAVIS

Investigation of soil acidity by means of plant experiments. H. KAPPEN. *Z. Pflanzenernahr. Dungung* **4A**, 202-11 (1925).—The height of alfalfa plants was inversely correlated to a high degree with the amt. of hydrolytic acidity found in the soil. Barley, turnips, clover beans, alfalfa and mustard are more sensitive to exchange acidity than oats, corn, rye, and potatoes. Physiologically alk. fertilizers are more beneficial to the latter group of crops than to the preceding. Superphosphate does not increase the exchange acidity of the soil to which it is applied. Its use in large quantity prevents $(\text{NH}_4)_2\text{SO}_4$ rendering the soil acid.

A. L. MEHRING

Soil acidity and its determination. B. TACKE. *Z. Pflanzenernahr. Dungung* **4A**, 215-6 (1925). The author's method for detg. soil acidity gave results not always in agreement with those obtained with Daikuhara's method.

A. L. MEHRING

Soil acidity and its determination. E. RAMANN. *Z. Pflanzenernahr. Dungung* **4A**, 217-21 (1925). The relation of acid permutites to acid soils is discussed.

A. L. M.

Base exchange in relation to the swelling of soil colloids. E. A. FISHER. *Trans. Faraday Soc.* **20**, 603-4 (1925). There is evidence that this problem might be profitably investigated in the light of the Donnan theory.

P. R. DAWSON

Base exchange in relation to adsorption. E. A. FISHER. *Trans. Faraday Soc.* **20**, 599-602 (1925). A discussion and argument for a chem. explanation of many so-called "adsorption" phenomena.

P. R. DAWSON

Considerations on some elements of the fertility of the soil in Ticino (Tessin) Canton. A. VERDA. *Helv. Chim. Acta* **8**, 412-38 (1925).—From an agricultural viewpoint the canton is divided into (1) the plain of Magadino, (2) the delta of the Maggia, (3) the plain of Veduggio, (4) the delta of Cassarate, (5) the Scairolo plain, and (6) the Mendrisio district. Numerous chem. analyses of the surface and subsoil waters and of the rocks and many mechanical and chem. analyses of the soils of these regions are given.

ALBERT R. MERZ

Chemical analysis and fertility of West Virginia soils. A. C. BRYAN and E. P. DEATRICK. West Virginia Agr. Expt. Sta., *Bull.* **184**, 27 pp. (1924).—The chem. analysis of 485 soils representing the important soil series of the State are reprinted. Soils derived from sandstone and shales have lower N and P content than those derived from limestone, and are more acid and less fertile. All the soils contained an av. of 1% of K. The sandstone and shale soils respond to treatments of P, N and lime.

J. J. S.

The experimental sprinkling of farm land with Dresden sewage. FLECK and HEILMANN. *Gesundh. Ing.* **48**, 6-8 (1925).—Farm land which has been sprinkled with filtered Dresden sewage produces, at a profit, considerably greater crops than land not so treated. These expts. are to be enlarged and contd.

M. E. F.

Soil bacteriological studies. M. DÜGGELI. *Landw. Jahrb. Schweiz.* **38**, 203-51 (1924); *Expt. Sta. Record* **52**, 720.—A summary is given of the results of a large no. of studies begun in 1908 on the activities of soil organisms, particularly N-fixing organisms, in certain Swiss soils under different methods of fertility treatment. The results showed that soils fertilized with potash and P_2O_5 , but not with N, contained a much greater no. of nonsymbiotic N-fixing organisms of aerobic types, such as *Azotobacter chroococcum*, and of anaerobic types, such as *Bacillus amylobacter*, than soils fertilized with NaNO_3 . The latter soils contained the greater no. of denitrifying organisms. Plowing these soils and treating them with liquid cow manure or stable manure increased the nos. of *A. chroococcum*, but plowing seemed to be somewhat injurious to the *B. amylobacter*.

A marked decrease in bacterial nos. in these soils was noted during the period from April to July. This was found to be due not only to a decrease in the amt. of available moisture and easily assimilable org. matter, but also to the rapid multiplication of soil protozoa, which was favored by the higher soil temps. In fact, the destruction of bacteria by protozoa during this period is considered to be the greatest cause of their rapid decrease in nos. H. G.

Behavior of bacteria, especially soil bacteria, toward carbon disulfide and the influence of treating soils with carbon disulfide on plant growth. A. MAASSEN AND H. BEHN. *Arb. Biol. Reichs. Land-Forstw.* **12**, 285-338(1924); *Expt. Sta. Record* **52**, 721.—Liquid CS_2 reduced markedly the no. of bacteria in soils, being the most destructive to the nitrifying bacteria and the least to the denitrifying and putrefactive bacteria. It was as destructive to soil bacteria when dissolved in water as when in vapor form. The vapor form was more destructive to *Azotobacter* than water half satd. with CS_2 , but less so than fully satd. water. Further expts. showed that the treatment of ordinary soils in the field with CS_2 generally favored plant growth. This favorable influence was usually also observed in pot expts. However, soil which had shown increases in yield due to such treatment in the field did not so react when potted. No increase in crop yield resulted from the treatment of sterilized soil with CS_2 . There was usually a residual effect of CS_2 treatment in field soils, which was noticeable in the second crop, but no such residual effect was observed in pots. The favorable action of CS_2 on the yield of crops and its residual effect were considerably weakened by the addn. of org. nitrogenous material, such as bone meal, manure, or moor soil. This was especially true with manure when added some time before the CS_2 treatment and indicates that the favorable influence of CS_2 is not due to an increase in the availability of nitrogenous org. matter. The yields of crops in soils well supplied with sol. plant nutrients were usually increased by CS_2 treatment, although this effect was not observed in sterilized soils aside from a small increase in yield in sterilized but fertilized sand. This indicates that CS_2 exercises a growth-promoting action on crops. However, it is concluded that the favorable residual effect of this substance cannot be explained in this manner, but may be due to chem. or biological changes produced. It is also considered possible that the favorable influence of treatment with CS_2 is due to partial sterilization of the soil, whereby injurious organisms are killed and organisms tending to increase the supply of available plant nutrients are permitted to multiply in greatly increased nos. H. G.

Phosphoric acid as an industrial chemical reagent. J. W. TURRENTINE. *Chem. Met. Eng.* **32**, 291(1925).—"Emphasis should be placed on the potential value of H_3PO_4 to agriculture through its use as an industrial chem. reagent as a possible substitute for H_2SO_4 and other acids in those applications where sol. phosphates useful for fertilizer may be yielded as a by-product." E. J. C.

Two new calcareous fertilizers, "Fosfaragonite" and "Carbide Italia." ANON. *Giorn. Riscicoltura* **15**, 120-3(1925).—"Fosfaragonite" analyzed 2.10% H_2O , 39.21 CO_2 , 1.01 P_2O_5 and 4.48 total SiO_2 . "Carbide Italia" contained 9.00% H_2O , 30.14 CO_2 and 2.00 total SiO_2 . ALBERT. R. MERZ

Carbon dioxide fertilizer GERLACH AND SEIDEL. *Z. Pflanzenernähr. Düngung* **4B**, 241-7(1925).—A material consisting mainly of finely ground peat, wood charcoal and pyrolusite is said to liberate CO_2 in the soil by catalytic oxidation. This material injured lupines when applied to them. A. L. MEHRING

Action of silica in increasing the yield (of plants). O. LEMMERMANN, H. WIESSMANN AND K. SAMMET. *Z. Pflanzenernähr. Düngung* **4A**, 265-315(1925).—"When SiO_2 is deficient, SiO_2 greatly increases the yield of dry matter and grain of various crops in sand culture. The exptl. results are presented in 25 tables. The results indicate that SiO_2 cannot replace P_2O_5 in the metabolism of the plant nor make up the total mineral constituents necessary but not satisfied by P_2O_5 . The increases are believed to be due to the presence of SiO_2 , rendering the P_2O_5 more available to the plant. A. L. MEHRING

Action of silica in increasing the yield (of plants) in sand cultures with insufficient phosphoric acid. FR. DUCHON. *Z. Pflanzenernähr. Düngung* **4A**, 316-25(1925).—"The increased yield obtained by Lemmermann and his colleagues in sand cultures deficient in P_2O_5 by adding colloidal SiO_2 is believed to be due to the improvement of the physical condition of the soil. Other colloidal materials or green manure added to sand also reduce the amt. of phosphatic fertilizers needed. In natural soils contg. sufficient colloidal material the addition of SiO_2 has no effect. A. L. MEHRING

Remarks on the article by Fr. Duchon. O. LEMMERMANN. *Z. Pflanzenernähr. Düngung* **4A**, 326-30(1925).—In reply to Duchon (preceding abstract) it is claimed

that colloidal SiO_2 does not affect the absorption of N and K_2O by plants as it does P_2O_5 . Furthermore, the effect of SiO_2 was observed in sand cultures to which humus was added.

Physiological character of ammonium nitrate (towards plants). D. N. PRIANISCHNIKOW. *Z. Pflanzenernähr. Düngung*, **4A**, 242-50 (1925).— NH_4NO_3 is usually physiologically acid. In solns. of p_{H} 4.0 corn plants absorbed the NO_3 ions 4 times as rapidly as the NO_3 ions. Its presence in the soil enables grass to utilize the P_2O_5 in phosphorite.

Carbon dioxide as a stimulant and fertilizer. W. SCHMIDT. *Z. Pflanzenernähr. Düngung*, **4B**, 162-71 (1925).—Pine seeds germinated more rapidly at first in an atm. enriched with small amts. of CO_2 . The complete germination process was not benefited, however. Large amts. of CO_2 were injurious.

Ferric glycerophosphate and soluble ferric phosphate as sources of iron for soybean plants in solution cultures. R. P. MARSH. New Jersey Agr. Exp. Sta., *Ann. Rept.* 1923, 247-52.—The growth of plants in culture solns. receiving ferric glycerophosphate was greater than in solns. with ferric phosphate. Ferric phosphate produced Fe toxicity, while the same concn. of glycerophosphate produced normal plants. Plants in both solns. showed a marked decrease in yield with an increase in the amt. of $(\text{NH}_4)_2\text{SO}_4$ supplied to the solns.

Iron solubility tests in culture solutions at different p_{H} values. R. P. MARSH. New Jersey Agr. Exp. Sta., *Ann. Rept.* 1923, 252-6.—The soly. of ferric glycerophosphate, sol. ferric phosphate, ferric tartrate and ferrous sulfate in culture soln. of varying p_{H} values was studied. Difference in soly. of the various compds was noted. The soly. was influenced by the H-ion concn. of the solns. Ferric glycerophosphate can be used as a source of Fe for plants without danger in cultures in which the H-ion concn. is kept at a high level during the growth of the plants. In solns. where the H-ion concn. approaches the neutral point ferric tartrate is more effective.

The salts of manganese, of aluminium, and of iodine in the fertilization of the sugar beet. T. COSTA. *Staz. sper. agrar. ital.* **57**, 430-4 (1924).—Contrary to the report by J. Stoklasa (*C. A.* **18**, 1005), no favorable influence was revealed either by KI or by MnSO_4 (alone or with $\text{Al}_2(\text{SO}_4)_3$) on the wt. or on the sugar content of the sugar beet.

The influence of aluminium, manganese and iron salts upon the growth of sugar cane, and their relation to the infertility of acid Island soils. W. T. McGEORGE. *Exptl. Sta. Hawaiian Sugar Planters Assoc. Bull.* **49**, 95 pp (1925).—Salts of Al in concns. which are present in many acid Island soils exercise a retarding action and often a severely toxic action upon the growth of sugar cane. Mn salts have no effect upon the root growth of sugar cane in water cultures. The Lahania variety is less resistant toward Al toxicity than D1135 or H109. Acidity *per se* or H ion concn. of the intensity present in our most acid soils has no influence upon the growth of sugar cane. The Al salts which are present in such types retard the plant growth. Al toxicity is a direct toxic action and not a P_2O_5 deficiency, although increasing the P_2O_5 or K_2O reserve of the plant increases its resistance. Cane plants grown on acid soil contg. sol. Fe and Al are characterized by abnormal accumulations of these elements in the nuclei surrounding the xylem cells at the nodal joint of the stalk. Acid Island soils contg. sol. Al will respond markedly to sol. P_2O_5 applications. The P_2O_5 is rapidly fixed and only effective over a short period. There is also a marked response to heavy K_2O applications but not always to ordinary amts. CaO gave no immediate response but there was a greater residual stimulation in plant growth. These investigations prove that Al is a factor directly associated with the retarded growth of sugar cane on the acid Mauka lands and that both P_2O_5 and K_2O may exert an influence on plant growth other than as a direct plant food. It is not suggested that Al is the cause of "Lahania disease," but rather that it is one of the several factors involved in the low fertility of some Island sugar lands. A bibliography of 36 citations is included.

Chemical studies of the combined lead arsenate and lime-sulfur spray. R. W. THATCHER AND L. R. STREETER. New York Agr. Expt. Sta., *Bull.* **521**, 3-20 (1924).—In mixts. of Pb arsenate and in lime sulfur alone a definite chem. change took place with an increase in insol. material to double the original amt. The solid material contained some unchanged Pb arsenate, Pb sulfide, Ca arsenate and free S. The filtrate contained more sol. As than was present in the original mixt. This mixt. was less fungicidal and more harmful to foliage than the original. $\text{Ca}(\text{OH})_2$ added in proportion of 5 lbs. per 100 gallon of the mixt. prevented changes, and casein was a good protector. Expts. were conducted to study the effect of tobacco dust, and skim milk with $\text{Ca}(\text{OH})_2$ as protectors.

J. J. SKINNER

Manganese chlorosis of pineapples; its cause and control. M. O. JOHNSON. *Hawaii Agr. Expt. Sta., Bull.* 52, 38 pp. (1924).—The Mn of the highly manganiferous Hawaiian soils is present mainly in the form of MnO_2 ; H-ion detns. indicate that these soils are acid; $CaCO_3$ is absent. A series of expts. was conducted with rice grown in nutrient solns. to det. the effect of $MnSO_4$ and MnO_2 on the growth where various amts. of Fe were supplied from various sources. Preliminary expts. indicated that the effect of Mn depends largely upon the amt. of Fe supplied by the soln. When the nutrient soln. contained a normal amt. of Fe, $MnSO_4$ and MnO_2 caused a strong chlorosis and depression in growth. This chlorosis was overcome when the leaves were dipped in solns. of Fe salts or the amt. of Fe in the nutrient soln. excessively increased. The Mn-induced chlorosis is thus shown to be due to a depression in the assimilation of Fe or to a deficiency of Fe in the plant. It is altogether distinct from lime-induced chlorosis, due to $CaCO_3$, since it can and usually does, occur under acid conditions. Mn and $CaCO_3$ can each produce an additive chlorotic effect in the presence of the other. No evidence has been found to show that Mn exerts any stimulating effect on plant growth. With nutrient solns. contg. an excessive amt. of Fe, MnO_2 , by removing some of this harmful Fe, caused an increase in growth. NaOH titration curves are given for $FeCl_3$ and $FeSO_4$. Detn. of the soly. of Fe at different H-ion concns. shows that Fe^{+++} is completely pptd. while the soln. is still strongly acid and that Fe^{++} is sol under fairly alk. conditions. This difference in the soly. of Fe^{+++} and Fe^{++} affords an explanation of the manner in which Mn induces chlorosis. MnO_2 , either present as such, or formed from manganous salts, would keep the Fe present oxidized to the much more difficultly sol. ferric form. Field expts. are described in which solns. of Fe salts were applied to the leaves of pineapple plants on manganiferous Hawaiian soils, resulting in immediate cure of "toxic effects" of Mn and the resumption of normal growth. Such treatment has been widely adopted in practice.

P. R. DAWSON

Deposits of arsenic and copper on eating apples. ANON. *J. Ministry Agr.* 32, 519-53 (1925).—Detns. of As, Cu and Pb were made on the skin, stalk and calyx of 24 samples of eating apples from England, Canada and the United States. The results were somewhat higher with the American and Canadian apples, probably on account of later spraying in these cases. In 23 cases the quantities present were too small to be regarded as harmful even if the whole of the apples had been eaten. One Canadian sample was exceptionally high and suggested the need of caution in late spraying with Pb arsenate.

P. R. DAWSON

The Hoffmann system of sewage purification (KEPPNER) 14. Utilizing residual waters from pressing beetroot [as fertilizer] (U. S. pat. 1,552,737) 28. Treating waste organic mixtures containing N and K compounds [for fertilizer] (U. S. pat. 1,552 732) 16.

Fertilizer. M. IGAWA and ASAHI GARASU KABUSHIKI KAISHA. *Brit.* 219,748, Jan 29, 1923. Other inorg. colloidal materials such as oxides of Al or Mn or Al silicate are used in nitrogenous fertilizers instead of colloidal Mg silicate as specified in *Brit.* 218,401 (C. A. 19, 556).

Fertilizer. G. GARBIN and S. TONIOLO. *Brit.* 231,018. April 24, 1924. Natural phosphate in colloidal form is mixed with NH_4NO_3 or urea or both.

Fertilizer. J. S. G. TELFER. *Brit.* 231,021, May 3, 1924. A liquid fertilizer is formed from H_2O and a mixt. of NH_4 phosphate, $(NH_4)_2SO_4$, $NaNO_3$, $CaCO_3$ or Ca phosphate, kainite, NH_4NO_3 and K_2CO_3 .

Producing fertilizer, etc., from fish waste. H. KRAMER and A. REIFFUN. U. S. 1,550,268, Aug 18. See *Brit.* 225,949 (C. A. 19, 1620).

Insecticides. H. B. GOODWIN. U. S. 1,554,629, Sept. 22. A gum-resin deriv. such as gamboge is added to aq. insecticides which may contain Pb arsenate for spraying, in order to reduce the surface tension of the material. Tannin also may be used.

Insecticide. W. L. OWEN. U. S. 1,555,951, Oct. 6. An insecticide in jelly-like form comprises agar and a poison such as Ca arsenate.

Insecticide. R. C. ROARK. U. S. 1,553,112, Sept. 8. Powd. As is used for spraying or dusting purposes on plants, trees, etc.

Insecticide. C. O. NELSON. U. S. 1,553,002, Sept. 8. A mixt. for treating live stock as an insect repellent comprises salt 80, S 15 and lime 5%.

Disinfectant, insecticide, etc. FARBENFABRIKEN VORM. F. BAYER & Co. *Brit.* 232,249, April 10, 1924. A compn. of bactericidal, insecticidal and fungicidal properties is prepd. by treating a salt of a basic dye such as malachite green with arsenious or arsenic acid. Cf. C. A. 19, 3142.

16—THE FERMENTATION INDUSTRIES

C. N. FREY

Dehydration of rectified spirit by means of anhydrous calcium chloride. J. J. SUDBOROUGH AND P. R. AYYAR. *J. Indian Inst. Sci.* **8A**, 49-54(1925).—Distg. 88% alc. (by wt.) with $\frac{1}{6}$ its wt. of CaCl_2 (1 mol. CaCl_2 for 4.5 mol. H_2O) can give 95% by wt. alc. in 95% yield. Increasing the proportion of CaCl_2 slightly increases the concn. of the distillate, but decreases the yield. A second distn. with 1 mol. CaCl_2 for 1.1 mol. H_2O gives an 86% yield of 98% by wt. alc. Further concn. by distn. with CaCl_2 is tedious, and 99.5-100% alc. is best produced by treating the 98% alc. with 5% (on the wt. of the alc.) of fresh Ca turnings. The alc. retained by the CaCl_2 soln. during the 2nd distn. can be recovered by adding H_2O and distg. As a rule it does not pay to recover the CaCl_2 . A. PAPINEAU-COUTURE

Heat disturbance and temperature optimum in different strains of vinegar bacteria. M. WÜSTENFELD. *Deut. Essigind.* **39**, 331-2(1925).—A series of expts. is described showing that different strains of rapid vinegar bacteria exist which possess unlike temp. optima, and that the most efficient strain must be the one possessing the highest temp. optimum, because its greatest efficiency must be intimately connected with uninterrupted high heat production, as opposed to less efficient strains whose optimum oxidation activity suffers diminution at relatively low temps. W. O. E.

Evolution of free acidity during the fermentation of beers. VAN LAER. *Petit J. brasseur* 1925, 674; *Brasserie et malterie* **15**, 200-3(1925).—Free acidity is one of the most important factors involved in the stability of beer. Addn. of strong acids to decrease the p_H is delicate, and not advisable in practice. Increase in acidity during fermentation can depend on the compn. of the wort and on the nature of the yeast. The effects of the compn. of the wort are due mainly to the amt. of buffer compds. which van Laer measures by detg. the "buffer no.," $10/E(P_1 - P_2)$, in which P_1 and P_2 are the resp. p_H of the wort before and after addn. of 4 cc. 0.1 N acid per 100 cc. of wort, and E is the ° Balling. There should be enough buffer compds. to prevent undue increase in the p_H due to the alk. salts in the water, but not enough to prevent its decrease during fermentation. The buffer effects of amino acids were shown by comparison of worts prepd. with pure malt and with the same malt contg. 40% radicals (p_H 1.29, 2.40, resp.); this shows that worts with high amino-acid content will have too low an acidity for proper stability of the beer. Different brewing methods have little or no effect on the buffer no. of the wort. The action of the yeast on the p_H can vary within wide limits according to the compn. of the wort; and worts having widely different compns. can give beers having practically the same p_H , so that if the acidity of the beer is to be increased, it is preferable to add the acid after fermentation. A. P.-C.

Multiplication of yeasts in solutions of purified nutrients. MARGARET B. MAC DONALD. *Am. J. Hyg.* **5**, 622-34(1925).—The object of this paper is to suggest probable causes of failure to secure continuous multiplication of yeast cells in sugar-mineral salt nutrient solns. and of irregularities in the behavior of "bios" concentrates. The topics which are treated with much detail are: an adequate medium, the importance of acclimatization, the protection of yeast cells and the effect of "bios" concentrates and exts. The results are shown in 5 tables. No conclusions are drawn. L. W. R.

Corn whiskey and its constituents. H. M. STEVENSON. *Texas State J. Med.* **20**, 562-6(1925).—An examn. was made of seized illegitimate liquors. The compn. of the fusel oil from 200 samples of corn whiskey was approx. as follows (parts per 1000) isopropyl alc. 750, *n*-propyl alc. 180, isobutyl alc. 40, amyl alc. 20, undetd. 10. Fusel oil manufd. under controlled conditions contains 800-950 parts per 1000. S. concludes from the low amyl alc. content of illegitimate liquors and the relative non-toxicity of isopropyl alc. that such liquors are relatively non-toxic from the fusel oil point of view. The content of acetaldehyde is 300-400% of that found in bonded whiskies. Zinc and copper salts seldom occurred. The toxicity of the constituents of fusel oil is discussed. P. E. H.

Preparation of sparkling wines with varieties of Piedmont grapes. F. MARTINOTTI AND E. GARINO-CANINA. *Slaz. sper. agrar. ital.* **57**, 379-93(1924). Analyses of the wines at various stages of elaboration are given. ALBERT R. MERZ

K values from residues of molasses fermentation (U. S. pat. 1,555,512) 18.

Dealcoholizing beverages. C. I. CASPAR. U. S. 1,553,748, Sept. 15. A body of the beverage maintained in a tank and which may have a temp. of between -5° and

60° is drawn from and sprayed into a gaseous medium which is at a lower temp. than that of the beverage and is then returned to the supply tank. Alc. which is taken up by the gaseous medium is condensed from it and the dealcoholized gas is then returned for further circulation in contact with the sprayed beverage.

Treating waste organic mixtures containing nitrogen and potassium compounds. G. T. REICH. U. S. 1,552,732, Sept. 8. Waste mixts. such as distillery slop are treated with $(\text{NH}_4)_2\text{SO}_4$ to convert the K compds. to K_2SO_4 and form a product adapted for use as a fertilizer.

17—PHARMACEUTICAL CHEMISTRY

W. O. EMERY

An apparently new substance in lemon oil. GIOVANNI ROMEO. *Ann. chim. applicata* 15, 305-9(1925).—Lemon oil which had been deterpenated by concn. *in vacuo* and steam distn. deposited on the walls of the container on standing a cryst. substance, which in some cases redissolved later spontaneously (hydration and dehydration). Crystd. from boiling H_2O , this gave lustrous crystals having a bitter taste but no odor. Its soly. in boiling H_2O was about 7% and in cold H_2O about 1%. In MeOH, EtOH, EtO, EtOAc and C_6H_6 it was much more sol. and from dil. EtOH crystd. spontaneously. When crystd. from H_2O it m. 58°, the liquid being turbid because of the H_2O of hydration. After dehydrating over H_2SO_4 , the compd. m. 69-71° and b. 260° with slow decompn. It was dextrogyratory, a 6.24% EtOH soln. of the anhydrous compd. giving $[\alpha]_D +39.26^\circ$. The anhydrous form had the compn. $\text{C}_{10}\text{H}_{15}\text{O}_2$ but after crystn. from H_2O had the compn. $\text{C}_{10}\text{H}_{15}\text{O}_2 \cdot 3\text{H}_2\text{O}$. It gave a bright red color with concd. H_2SO_4 and an aq. soln. decolorized KMnO_4 and aq. Br. Evapn. of aq. Br contg. the compd. gave a marginal red-violet color with evolution of a thyme or mint odor and fumes of HBr. It could not be sapond. with alc. KOH but it reduced ammoniacal AgNO_3 soln. It gave no color with FeCl_3 . Treated with H_2SO_4 or HCl its satd. aq. soln. gave a 15% yield of a yellow oil which, extd. with Et_2O , had a thyme or mint odor and was insol. in KOH soln. Analysis showed that this oil was not formed through dehydration by the acids analogous to the formation of pulegone; but that it probably had the compn. $\text{C}_{10}\text{H}_{15}\text{O}_2$ like the solid and was an isomer. Further identification was impracticable.

C. C. DAVIS

Behavior of various aromatic substances in Vitali's reaction. H. W. VAN URK. *Pharm. Weekblad* 62, 926-32(1925).—Vitali's test for *atropine*, whereby evapn. of the sample with HNO_3 and treatment of the residue with alc. KOH gives an intense purple color, was applied to a large no. of aromatic derivs. The great majority of these gave color reactions, with the development of orange, red, green, brown or even violet color. The reaction is probably dependent on the nitration of a Ph group. It is readily obtained when the Ph is linked to N, and the color is intensified by the presence of OH groups. Where the Ph is linked to C, as in BzOH, cinnamic acid, $\text{C}_6\text{H}_4(\text{CO})_2\text{O}$, saccharin, luminal, etc., no color develops except a yellow in the case of phenols, ketones and aldehydes. Polyatomic phenols react explosively with the HNO_3 . A. W. DOX

An introduction to the evaluation of our medicinal agents. P. VAN DER WIELEN. *Pharm. Weekblad* 62, 942-61(1925).—A popular lecture on drug assay by means of phys., chem. and physiol. properties. A. W. DOX

Digitalis and digitalis preparations. J. S. MEULENHOFF. *Pharm. Weekblad* 62, 961-82(1925).—A study of the activity of digitalis preps. as influenced by the source of the crude drug, the method of extn. and the age of the prepn. A. W. DOX

Characteristic reactions of luminal. F. RANWEX. *J. pharm. Belg.* 6, 501-5(1924).—Reduce the nitroluminal, prepd. by adding to the mixt. granulated Zn + dil. H_2SO_4 . When soln. is complete decant the clear liquid and cool it to 5°. Add to the cold liquid about 0.10 g. of KNO_2 dissolved in H_2O . Diazoluminal forms immediately and remains in soln. at this diln. This is identified by the following color reactions: (1) On the addition of a few particles of β -naphthol to a portion of the soln., an intense blood-red coloration is produced. (2) The addition of α -naphthol followed by NaOH to alkyl. gives an intense orange-red color. (3) Sodium β -naphthol-3,6 disulfonate gives a cherry-red color. (4) Phenol gives a deep brown color. (5) Resorcinol gives an intense orange-brown color. (6) Phloroglucinol gives a brownish red color. (7) Guaiacol gives a yellow-brown color. (8) Potassium *o*-guaiacolsulfonate (thiocol) gives a yellow-brown color. (9) Thymol gives a brown-yellow color. (10) Eugenol gives a bright cherry-red color. No results were obtained with vanillin. Hy-

droquinol and salicylic acid do not react. Pyrogallol and gallic acids do not produce characteristic colors. Cf. *C. A.* **18**, 2408. A. G. DuMEZ.

Otto of rose from the analyst's point of view. W. H. SIMMONS. *Perfumery Essent. Oil Record* **16**, 341-4 (1925).—The principal subjects discussed are: nature of raw material, process of distn., and distn. plant employed, as constituting the 3 important factors which have to do with the question as to what genuine otto of rose actually is. Further points considered are: compn. of otto of rose, standards and examn., sp. gr., optical rotation, refractive index, melting point, sapon. value, total alcs. W. O. E.

Anatomical critique of officinal seeds and fruit. FRITZ NETOLITZKY. *Pharm. Monatshefte* **6**, 149-55 (1925).—The examn. of the cork and cuticular membranes of some 20 different products is discussed, notably with respect to their behavior toward potash, HNO_3 - KClO_3 mixt. and CrO_3 . W. O. E.

New color test for amylene hydrate (tertiary amyl alcohol). L. EKKERT. *Pharm. Zentralhalle* **66**, 599 (1925).—On mixing 0.5 cc. of a 5% alc. soln. of amylene hydrate with 5 cc. concd. H_2SO_4 and then superimposing on the warm yellow mixt. a 5% soln. of tartaric acid, a rose-red color develops at the surface of contact, the entire upper layer finally acquiring this tint. The tartaric acid may be replaced by guaiacol, K guaiacolsulfonate or resorcinol. The color is still pronounced with only 1 drop of 5% alc. amylene hydrate. W. O. E.

Travancore essential oils. VI. From *Cymbopogon caesius* Stapf (Inchi grass). KISHORI LAL MOUDGILL. *Quart. J. Indian Chem. Soc.* **2**, 23-38 (1925); cf. *C. A.* **19**, 2388.—Oils distd. from both varieties (red and white) of this grass from the same locality and at the same time showed: d_4^{20} 0.9130, 0.9110; n_D^{20} 1.4820, 1.4815; $(\alpha)_D^{20}$ -3.60° , -40.0° ; acid no. nil; ester no. 11.4, 9.2; ester no. after acetylation 121.8, 117.4, resp. The product presents a sweet smelling oil, quite different in character from the oils obtained from similar grasses but resembles palmarosa oil in odor. It occurs both in the flowers and leaves, undergoes no change on storage, that from the leaves being fairly uniform during different stages of plant growth, the flower oil being richer in sesquiterpenes and having a much lower Ac value. The constituents of the oil are *l*-limonene, *l*-camphene, *l*-borneol, *l*-terpeneol, a bicyclic sesquiterpene (d_4^{20} 0.9064, n_D^{30} 1.5005, $(\alpha)_D^{30}$ -12°), a tertiary sesquiterpene alcohol ($\text{C}_{15}\text{H}_{26}\text{O}$), and a terpene alcohol as yet uncharacterized. In addn the presence of an aldehyde yielding a Na salt of sulfonic acid on treatment with NaHSO_3 , esters of acetic, butyric and an unsatd. acid $\text{C}_{16}\text{H}_{30}\text{O}_2$ was noted. W. O. E.

The evaluation of insulin preparations. F. DEPISCH, F. HOGLER AND K. UEBERACK. *Klin. Wochschr.* **3**, 1064-5 (1924).—Insulin preps. are frequently mislabeled as to strength. This is probably due to faulty methods of assay. The authors suggest changing the value of 1 unit to that quantity of insulin that will reduce the blood sugar value to at least 45 mg. % and produce cramps in 3 out of 4 animals. The labeled and actual strengths of 20 preps. from various manufacturers are given. M. H.

Evaluation of hypophyseal extract using the frog reaction of Hogben and Winton. M. KOCHMANN AND W. WAGNER. *Klin. Wochschr.* **4**, 1503-4 (1925); cf. Treuter, *Zentr. Gynakol.* **1924**.—The dark coloration of the skin that occurs in frogs after an injection of hypophyseal ext. can be used as a crude method for evaluating such exts. This method is inferior to the uterine strip method. MILTON HANKE.

A new purgative, the oil of the "castor oil fish," *Ruvettus*. E. W. RUDGER. *Bost. Med. Surg. J.* **192**, 107-11 (1925).—This fish is a deep water fish of rather wide distribution but not very common. Its flesh and bones are rich with a limpid oil which causes a mild diarrhea when the former are eaten. No attempt has been made to analyze this oil and ascertain the purgative agent. JULIAN H. LEWIS.

Chemical composition of the stem bark of purgative buckthorn (*Rhamnus cathartica* L.). M. BRIDEL AND C. CHARAUX. *Ann. chim.* [10], **4**, 79-120 (1925).—The bark of *Rhamnus cathartica* L. contains an unstable glucosidic complex, *rhamnarticoside*, which is dissociated by cold water giving a crystd. insol. glucoside, *rhamnicoside* (I) (new), and sol. glucosides hydrolyzable by the enzyme of *Rhamnus* seeds. The products of hydrolysis of the glucosides gave the following cryst. compds.: *primeverose*, *emodin*, and another hydroxymethylanthraquinone compd., m. 234° . I has $(\alpha)_D$ -78.12° , crystallizes in needles, is insol. in water, with alkalis and alk. earths gives crystd. colorless compds., which are slightly sol. in water, very readily decomposed by light and air into violet, blue or green compds. and are the base of the coloring matter known as "Lo-Kao" or Chinese green. I reduces Fehling soln. (1 g. = 0.206 g. glucose), is hydrolyzed by H_2SO_4 to an equimol. mixt. of glucose and xylose together with an insol. crystd. compd., *rhamnicogenol* (II) (new), is readily hydrolyzed by boiling water to II

and primeverose, and is also hydrolyzed to II and primeverose by the enzyme powder of *Cornus sanguinea* L., in spite of the practical insolv. of both I and the enzyme. II is a hydroxymethylanthraquinone compd., does not give with alkalis in presence of air the violet-blue coloration of I, gives a pink soln. with green fluorescence in presence of alkali, and is oxidized to a red soln. by excess of alkali. Analysis and reactions point to the formula $C_{20}H_{20}O_{15} \cdot 4H_2O$. Acid hydrolysis gives glucose, xylose and rhamnicogenol; fermentative hydrolysis gives primeverose and rhamnicogenol. II is thus a *pentahydroxymethylanthranol*. I has been identified in *R. utilis* (DCne), *R. infectoria* L., *R. Saxatilis* (Jacq), *R. oleoides* L., *R. italicus* (Horitecole), *R. cathartica* L., all of which are thorny and have an easily detachable epidermis; it is not found in *R. frangula* L., *R. alternus* L., *R. alpina* L., *R. japonica* (Maxim), *R. Billardii* (Horticole), none of which has thorns, and all of which have adherent epidermis. An enzyme which hydrolyzes I was isolated from the bark of *R. cathartica*.

A. PAPINEAU-COUTURE

Perfumes, natural and synthetic. W. B. GARNER. *Chem. Eng. Mining Rev.* 17, 201-5 (1925).—Brief general description of their method of manuf. A. P.-C.

Kachi-grass oil. B. S. RAO AND J. J. SUDBOROUGH. *J. Indian Inst. Sci.* 8A, 9-27 (1925).—Steam distn. of *Cymbopogon caesius* Stapf gave the following yields (on the dry basis): whole grass 0.22-0.53%, stalks and leaves 0.16-0.20%, flower-heads 1.10-1.61%, of oil which showed $d_{15}^{25} 0.9181-0.9789$, $n_D^{20} 1.4838-1.4907$, $[\alpha]_D^{25} +9.9$ to -62.5° , acid value 0.5-9.2, sapon. value 12.0-32.4, sapon. value after acetylation 114.6-172.3, total alcs. (as $C_{10}H_{18}O$) 34.5-54.4%. The yield of oil from mature and immature flower-heads is much the same. The oil becomes richer in oxygenated compds. as the flowers ripen, resulting in gradual increase in total alcs. and esters with corresponding increase in soly. in 70% alc. The d. and n tend to rise as the grass matures. The properties of the oils from the stalk and flower-heads do not vary much. Oil from green flowers has a relatively high l -rotation. Rotation seems to be due to the presence of d - or l -limonene, as high rotation is due to the lower terpene fraction and not to the higher alc. fractions. The above consts fall within the limits usually given for ginger-grass (*C. Martini sofua*) oil. Dipentene, limonene, geraniol and perillal alc. were identified. Insol. Kachi-grass oil can be rendered sol. by reducing the terpene content to 30%, either by removal under reduced pressure or by steam. Higher-boiling fractions are also insol. in alc., and freshly distd. oils, if insol. can often be rendered sol. by rejecting part of the higher-boiling fractions (usually the last 12%); but oils which have been kept for some time do not give sol. products under such treatment. On storage n rises and $[\alpha]$ falls, the change being the more marked in the alc. fractions than in the terpene fractions; but the total alcs. (via acetylation) in the oil does not change appreciably.

A. PAPINEAU-COUTURE

Essential oil of *Cyperus rotundus*. B. S. RAO, P. B. PANICKER AND J. J. SUDBOROUGH. *J. Indian Inst. Sci.* 8A, 39-47 (1925).—Steam distn. of tubers of *Cyperus rotundus* Linn., disintegrated through a 0.25-in. screen, gave 0.53-0.86% of oil with $d_{15}^{25} 0.9828-0.9907$, $[\alpha]_D^{25} +20.1$ to $+42.8^\circ$, $n_D^{25} 1.5126-1.5156$, acid value 2.1-3.4, sapon. value 11.7-16.1, Ac no. 66.5-98.1, which gave no absorption with 30% $NaHSO_3$ nor with 5% KOH. The lower fractions contain at least 2 sesquiterpenes with mol. refraction 65.5. Two or more alcs. are present. Total alcs. (as $C_{15}H_{26}O$) are about 30%. They do not react with phthalic anhydride, and are presumably tertiary. In addn. to alcs., the higher fractions contain large quantities of neutral substances, presumably hydrocarbons. No pure substances could be isolated from the oil. A. P.-C.

Notes on some Indian essential oils. B. S. RAO, J. J. SUDBOROUGH AND H. E. WATSON. *J. Indian Inst. Sci.* 8A, 143-88 (1925).—Steam distn. of the leaves of *Calitris rhomboidea* R. Br. (*Frenela rhomboidea*, Endl.) yielded 0.17% of oil with $d_{15}^{25} 0.8715$, $n_D^{25} 1.4703$, $[\alpha]_D^{25} -29.1^\circ$, sapon. value 47.1, esters (as $C_{10}H_{17}OCOMe$) 16.5%, contg. nearly 50% terpenes. Distn. of the oil at 683 mm. gave: 160-70° 43.3, 170-80° 11.9, 180-200° 17.0, residue 27.0%. *Inchi grass oil* from Travancore, *botha grass oil* from Madras and *bode grass oil* from Mysore had: $d_{15}^{25} 0.9200, 0.9038, 0.9231$; $n_D^{25} 1.4849, 1.4748, 1.4831$; $[\alpha]_D^{25} -40.0^\circ, +39.9^\circ, -24.7^\circ$; acid value —, —, 1.3; sapon. value 5.9, 44.7, 45.5; sapon. value after acetylation 98.4, 120.7, 112.7; total alcs. (as $C_{15}H_{26}O$) 29.2, 36.5, 34.4%, resp. On distn. under 683 mm., *inchi grass oil* gave 28.5% at 190-70°, 30.0% at 240-75°, both a grass oil gave 40% at 150-80°, 30% at 180-240° and 20% at 240-60°. Steam distn. of the roots of *cus-cus grass* (*Veliveria zizanoides*, Stapf) from Bangalore gave 0.63 and 0.79% of oil from first quality roots, and 0.20 and 0.28% from second quality, the resp. higher yields being obtained by soaking in water before distn. Two samples of the crude oil, and 2 of the redistd. oil had: $d_{15}^{25} 1.0028, 1.0030$,

1.0008, 1.0040; n_D^{25} 1.5214, 1.5210, 1.5210, 1.5191; $[\alpha]_D^{25}$ —, +25.5°, +24.2°, —65.0°; acid value 21.4, —, —, 41.2; sapon. value 31.0, 33.8, 29.7, —; ester value 10, —, —, —; ester value after acetylation 102.3, —, —, 146.8; total alcs. (as $C_{16}H_{34}O$) 43.4, —, —, 64.8, resp. Distn. under 10 mm. pressure gave: 145–65° 16.6% ($[\alpha]$ —4.3°), 165–75° 24% ($[\alpha]$ +16.0°), 175–80° 16.6% ($[\alpha]$ +26.6°), 180–95° 18.3% ($[\alpha]$ +36.2°), 195–215° 8.3%, 215–40° 8.3%, residue 6.6%. 85% of the residue is sol. in 98% (by wt.) EtOH, and the soln. (0.57%) has $[\alpha]$ +52°. Bangalore oil is midway between German (Semmler, C. A. 7, 213) and Reunion distd. oil as regards proportion of high-boiling constituents. No highly *d*-rotatory resin was found (cf. Singh, C. A. 9, 234). Steam distn. of dry, peeled, disintegrated *calamus roots* (*Acorus calamus*, Linn.) from Coimbatore district yielded 1.5% of oil with d_{15}^{15} 0.0694, n_D^{25} 1.5030, $[\alpha]_D^{25}$ +6.2°, acid value 1.4, sapon. value 5.1, sapon. value after acetylation 16.6, sol. at 8° in 1.5 vol. of 70% alc. Distn. under 10 mm. pressure gave: below 130° nil, 130–40° 13.3, 140–50° 13.3, 150–7° 66.6, residue 3.3%. Pinene, camphene and camphor are apparently absent. The *d*. is considerably higher and $[\alpha]$ somewhat lower than those of known com. samples of the oil. Steam distn. of waste *ginger* gave 3.54% of oil with d_{15}^{15} 0.8822, n_D^{25} 1.4898, $[\alpha]_D^{25}$ —39.2°, acid value 2.1, ester value 7.7, ester value after acetylation 49.8. Distn. under 685 mm. (at which the oil undergoes decompn.) gave: to 150° 1.4, 150–200° 5.0, 200–40° 12.3, 240–65° 40.0, 265–80° 29.8, residue 9.7%. The consts. are within the limits for ginger oil, except for the presence of a larger proportion of alcs. Steam distn. of disintegrated rhizomes of *Curcuma zedoaria*, Roscoe, yielded 1.01% (on the dry basis) of oil with d_{15}^{15} 0.9863, n_D^{25} 1.5024, acid value 2.1, sapon. value 9.8, sapon. value after acetylation 73.4, aldehydes (absorption with Na_2SO_3) 3.5, sol. in 1.5 vol. of 80% alc. at 15°. Distn. at 685 mm. pressure gave: 165–80° 11, 180–230° 23, 230–90° 56%. Steam distn. of *Elettaria cardamomum*, Maton yielded 2.42–6.45% of oil from seeds only, and 4.90–6.45% from seeds and pericarp. Crushing the material before distn. shortens the time of distn. and reduces steam consumption, but does not affect the yield of oil. The oils had d_{15}^{15} 0.9264–0.9349, n_D^{25} 1.4603–1.4620, $[\alpha]_D^{25}$ +15.1 to +44.0°, acid value 0.36–1.3, sapon. value 9.6–15.6. The low $[\alpha]$ observed in certain instances is possibly due to immaturity of the fruit. Steam distn. of *cubeb*s (*Cubeba officinalis*, Miq., *Piper cubeba*, Linn.) yielded 11.85% of light green oil with d_{15}^{15} 0.9167, n_D^{25} 1.4894, $[\alpha]_D^{25}$ —29.9°, sapon. value 0.5, sapon. value after acetylation 24.1, sol. in 5 vol. of 90% alc. at 16°. Fractionation at 685 mm. pressure gave: 140–70° 5, 170–225° 20, 225–45° 15, 245–65° 45, 265–80° 10, residue and loss 5%. Steam distn. of different portions of a 40-yr. old *camphor tree* gave: camphor % on total oil from leaves 30.5–43.0, from twigs 20.0–25.2, bark from branches 5.0, branches 5.9–10.9, main stem and large branches 12.0, roots 24.2, stump 17.5–25.0; camphor % on dry material from leaves 0.39–0.90, from twigs 0.17–0.33, bark from branches 0.02, branches 0.06–0.13, main stem and large branches 0.30, roots 1.91, stump 1.06–1.44; camphor oil % on dry material from leaves 0.32–1.20, from twigs 0.71–0.94, bark from branches 0.48, branches 1.04–1.13, main stem and large branches 2.0, roots 6.04, stump 4.36–5.04; total volatile oil % on dry material from leaves 0.82–2.10, twigs 0.88–1.27, bark from branches 0.50, branches 1.17–1.56, main stem and large branches 1.84–2.30, roots 7.95, stump 5.80–6.10. The results are compared in detail with numerous previously published results. Analytical consts. of some of the camphor oils after sepn. of the camphor, and of others before sepn. of the camphor, resp., gave: d_{15}^{15} 0.9106–0.9290, 0.9276–0.9518; n_D^{25} 1.4678–1.4793, 1.4680–1.4833; $[\alpha]_D^{25}$ 6.4–26.0°, 5.8–24.5°; acid value 0.6–2.3, 1.1 (only one value given); sapon. value 0.6–7.1, 1.0–4.0; sapon. value after acetylation 25.0–49.3, 25.7–40.0. A small proportion of safrole was found in the oils obtained from roots, stump and thick branches, but none from twig and leaf oils. Steam distn. of sun-dried carpels of *Zanthoxylum rhetsa*, D. C. yielded 5.8% (on the dry basis) of oil with d_{15}^{15} 0.8562, n_D^{25} 1.4663, $[\alpha]_D^{25}$ —32.6°, acid value 1.2, sapon. value 5.9, sapon. value after acetylation 49.3. Distn. of the oil at 7 mm. pressure gave: 48–52° 72.3% (n_D^{25} 1.4660, $[\alpha]_D^{25}$ —35.5°), 52–4° 16.0% (n_D^{25} 1.4660, $[\alpha]_D^{25}$ —32.8°), 54–90° 5.0% (n_D^{25} 1.4693, $[\alpha]_D^{25}$ —14.7°), residue 5.5% (n_D^{25} 1.4835), clearly indicating that nearly 90% of the oil consists of terpenes, chiefly *sabinene* (Wallach, C. A. 2, 1830). Extn. with petrole ether of the crushed pepper-like seeds of *Z. rhetsa* yielded 29.7% (on the dry basis) of oil contg. 2.7% (on the dry seeds) of a solid glyceride, m. 53°, sapon. no. 227.2. The liquid portion of the oil was not volatile with steam. Pcp. of *Citrus bigaradia* (Risso), by the ordinary sponge method gave 0.25–0.32% oil with d_{15}^{15} 0.8629–0.8658, n_D^{25} 1.4737–1.4749, $[\alpha]_D^{25}$ +84.7° to +88.2°, non-volatile residue 9.9–12.1%. Extn. of the pips with Et₂O gave 30.5

and 21.4% (on the dry basis) of fixed oil, which had, after sepn. of the solid portion, d_{15}^{15} 0.9243, 0.9257; n_D^{40} 1.4650, 1.4652; acid value 3.1, 2.9; sapon. value 198.5, 198.1; I value 94.0, 94.1. Steam distn. of *coriander* (*Coriandrum sativum*, Linn.) fruit yielded 0.25% (on the dry basis) of oil with d_{15}^{15} 0.8721, n_D^{25} 1.4576, $[\alpha]_D^{25}$ +13.7°, acid value 0.26, sapon. value 31.0, sapon. value after acetylation 45.4, sol. in 3 vol. of 70% alc. at 15°. Steam distn. of white *cumin* (*Cuminum cyminum*, Linn.) fruit yielded 2.35% of oil with d_{15}^{15} 0.8945, n_D^{25} 1.4910, $[\alpha]_D^{25}$ +3.6°, aldehydes (NaHSO₃ absorption) 16%, sol. in 11 vol. of 80% alc. at 20°. Steam distn. of *dill* (*Anethum sowa*, Roxb.) fruit yielded 2.17% of light oil and 1.02% of heavy oil, which had d_{15}^{15} 0.9313, 1.0935; n_D^{25} 1.4853, 1.5154; $[\alpha]_D^{25}$ +58.2°, —; carvone (absorption with NaHSO₃) 17%, —. The combined light and heavy oils had d_{15}^{15} 0.9785, n_D^{25} 1.4943, $[\alpha]_D^{25}$ +47.6°, carvone 19.5%. If the dill-apiol is removed from Indian dill oil, the consts. approx. to those of the European oil. Steam distn. of *Indian fennel* (*Foeniculum panmorium*, D. C.) yielded 0.53–0.82% (on the dry basis) of oil with d_{15}^{15} 0.9744–0.9767, n_D^{25} 1.5355–1.5383, $[\alpha]_D^{25}$ 11.7–16.9°, congealing point +5.5 to 9.0°, sol. in 1 vol. of 90% alc. at 6–10°. Fractionation at 7 mm. pressure gave: 54–75° 9.7% (n_D^{25} 1.4740, $[\alpha]_D^{25}$ +58.1°), 75–90°, 9.7% (n_D^{25} 1.5025, $[\alpha]_D^{25}$ +34.6°), 90–100° 7.0% (n_D^{25} 1.5031, $[\alpha]_D^{25}$ +9.5°), 100–1° 66.6% (n_D^{25} 1.5560, $[\alpha]_D^{25}$ nil, m. p. 21°), residue and loss 7.0%, indicating the presence of over 70% of anethole. Fenchone (6%) was found in the oil, but it is improbable that methyl-chavicol is present in any large quantity.

A. PAPINEAU-COUTURE

The new Swedish pharmacopeia. H. WASTENSON. *Svensk Farm. Tids.* 29, 393(1925).—Review.

A. R. ROSE

Hemolysin. K. A. KARSMARK. *Svensk Farm. Tids.* 29, 378–82(1925).—A system of evaluating the hemolytic potency of drugs. The drug of given concn. (0.001–1.0%) is dild. with saline soln. and 1 cc. added to 1 cc 2% blood-cell suspension making 2 cc. The tubes are arranged in the order of the increasing cc. (0.05–1.0) of the infusion and the first tube showing complete hemolysis is the key to the index table. For instance the 5th tube in the increasing scale contains 0.55 cc. 0.005% decoction of saponin. In table, p. 382, under vol. of hemolysin find 0.55, follow on line to column for 0.005% and find given 72,700. This number is the index number for the sample examd. A. R. R.

A chemical examination of oleoresin of Indian valerian root. K. BULLOCK. *Pharm. J.* 115, 122–5; *Chemist & Druggist* 103, 170–1(1925).—A large lot of Indian valerian root yielded to petroleum spirit 1.64% of ext., of which 47.4% the oleoresin (A), was sol. in 70% EtOH (cf. C. A. 18, 3451). Small samples of genuine root have yielded 2–3% of A. No alkaloid was found in A, but this and the root contain quite large amounts of free acids, mainly *valeric acid*; the others are a rather complex mixt. of satd. and unsatd. fatty acids. By the action of acids, alkalies and heat, A resinifies easily, caused in part by oxidation of the unsatd. fatty acids. The fatty matter insol. in 70% EtOH fails to give tests for glycerol. Unsapond. matter seems to contain a liquid hydrocarbon, b. p. about 120° (–140°) and a semi-solid alc., b. p. about 240°. S. W.

Notes on the quinine sulfate monograph of the Brit. Pharm. Codex 1923. B. F. HOWARD AND OLIVER CHICK. *Pharm. J.* 115, 125–7, 176; *Chemist & Druggist* 103, 172(1925).—The descriptions of Keller's test for cinchonidine, etc. in the Codex 1923 and the Brit. Pharm. 1914 are worded differently, involving a difference in the temp. of the 20 cc. of H₂O added: 60–65° (Brit. Pharm.), 15° then heating the mixt. to 60–65° (Codex). By the latter procedure, if official, highly pure quinine sulfate would appear to be below standard. Also, the soly. in dil. acids given in the Codex is impossible to attain, because of an oversight in not allowing for the reduced strengths of the acids in the present Codex as compared with that of 1911. S. WALDBOTT

Disinfectant (Brit. pat. 232,249) 15. Esters of 4-hydroxypiperidine (Brit. pat. 232,206) 10. Bu esters of phthalic acid (U. S. pat. 1,554,032) 10.

Medicinal composition. G. L. COUSINEAU. U. S. 1,554,155, Sept. 15. An aq. liquid contg. both sol. and insol. portions of testical gland is used for hypodermic injection for "practically every type of disease known."

Medicinal compounds from yeast and dyes. HACO-GES. AKT.-GES. Brit. 231,120, June 21, 1924. The process described in Brit. 230,404 (C. A. 19, 3351) is extended to the use of other thiazine dyes, e. g., yeast may be treated with Indochromine RR and the product further treated with NaBr; on filtering, washing and drying, the leuco compds. first formed are oxidized.

Sterilizing medicinal proteins, etc. C. A. MILLS. U. S. 1,556,120, Oct. 6. Materials such as serums, enzymic preps. or globulins are treated with HgCl_2 and the soln. is subsequently cleared by converting the Hg proteinate into the protein and a Hg compd. which is sol. and is removed by dialysis.

Isotonic solution. H. PORRATZ. U. S. 1,554,027, Sept. 15. A sterilized isotonic soln. adapted for medicinal purposes comprises a salt soln. and a soln. of a Ce compd. such as CeI_2 , the 2 solns. being of the same osmotic pressure.

Remedy for treating tumors, etc. L. LILIENFELD. U. S. 1,555,016, Sept. 29. A remedy for malignant tumors comprises aurous selenide, Au_2Se , together with Et or Me ethers of starch or cellulose or a similar carbohydrate ether which is sol. in cold but not in hot H_2O . Selenides or tellurides of Ir, Pd, Os, Pt, Hg, Ag, Cu or Sn also may be used.

Therapeutic substances from ovaries, etc. SOC. ANON. POUR L'IND. CHIM. À BÂLE. Brit. 226,372, Dec. 29, 1923. Physiologically active substances of ovaries, corpora lutea or placentas are obtained in concd. form by dissolving in a volatile solvent such as acetone and MeOH a prepn. such as described in Brit. 113,311 (C. A. 12, 1337) and treating the soln. with basic Pb acetate or cooling it to a temp. below -20° (or both).

Antitoxic serums. A. R. DOCHEZ. Brit. 232,181, April 14, 1924. In making serums for treatment of scarlet fever or other diseases for which a sol. toxin cannot be prepd. by cultivation of the bacteria *in vitro* or within an animal body in the usual manner, a fluid agar or similar compn. is injected into an animal, e. g., a horse, followed by injection of a bacterial culture, repeating this procedure and then obtaining the serum. Before these injections, in the case of *streptococci scarlatinae*, a horse is preliminarily tested for glanders and injected with tetanus antitoxin. The culture used for immunizing is subjected to frequent passage culture through mice and is preserved on ice in rabbit's blood broth.

Centrifugal apparatus for treating serum. E. R. ALEXANDER. U. S. reissue 16,162, Sept. 8. See original pat. No. 1,539,102, C. A. 19, 2262.

Chlorine-containing composition adapted for use in disinfecting. L. D. MATHIAS. U. S. 1,555,474, Sept. 29. Sufficient NaOH soln. is added to a soln. of di-Na phosphate to form the normal phosphate, and a NaOCl soln. is then added to form a compn. which contains at least 1% available Cl.

Menthol and related compounds. RHEINISCHE KAMPFER-FABRIK GES. Brit. 231,827, April 4, 1924. The mixt. of menthol and isomenthol obtained by the catalytic hydrogenation of thymol is sepd. by fractional distn., *in vacuo* or at atm. pressure, the isomenthol distg. first. The isomenthol is then subjected, either alone or with more thymol, to further hydrogenation, or is first dehydrogenated to isomenthone and the latter then hydrogenated.

Cod-liver-oil tablets. B. L. EICHER. U. S. 1,552,549, Sept. 8. Charcoal is mixed with reduced Fe and other medicines and pills or tablets formed of this mixt. are treated with a soln. of cod-liver oil in a volatile solvent such as ether and the solvent is then evapd.

Substituted barbituric acids. FARBENFABRIKEN VORM. F. BAYER & CO. Brit. 231,150, March 21, 1924. Δ^2 -Cyclohexenylethylbarbituric acid is prepd. by treating the Na compd. of monoethylmalonic acid ester with 1-bromo- Δ^2 -cyclohexene and reacting upon the resulting Δ^2 -cyclohexenylethylmalonic acid ester with urea. Δ^2 -Cyclohexenylallylbarbituric acid is similarly prepd. from the monoallylmalonic acid ester. The Na compd. of Δ^1 -cyclohexenylcyanoacetic acid ester is treated with EtI and the resulting Δ^1 -cyclohexenylethylcyanoacetic acid ester added to a soln. obtained by boiling guanidine sulfate with Na in alc., thus producing Δ^1 -cyclohexenylethylbarbituric acid; Δ^1 -methylcyclohexenyl- and Δ^1 -cyclopentenylcyanoacetic acid esters are transformed in the same way into Δ^1 -methylcyclohexenylethyl- and Δ^1 -cyclopentenylethylbarbituric acids, resp. The products are hypnotics.

Pyrazolone-barbituric acid compound. P. PFEIFFER. Brit. 231,512, Mar. 27, 1924. A double compd., in mol. proportions, of diethylbarbituric acid and 4-dimethylamino-2,3-dimethyl-1-phenyl-5-pyrazolone is prepd. from a soln. of the components. It is an analgetic and soporific.

2-Acetoxy-4-methoxybenzoic acid. FARBENFABRIKEN VORM. F. BAYER & CO. Brit. 231,886, April 4, 1924. This compd., an antipyretic, is made by acetylating 4-methoxy-2-hydroxybenzoic acid. Its alkali salts also possess antipyretic properties.

Thioglycolic acid derivative containing antimony and calcium. H. HAHN. U. S. 1,555,663, Sept. 29. A compd. of the formula $\text{Sb}_2(\text{S}-\text{CH}_2-\text{COO})_2\text{Ca} \cdot 3\text{H}_2\text{O}$ is obtained by reaction of thioglycolic acid, S_2O_3 and CaCO_3 . It is a whitish powder, sol. in H_2O to a slight alk. reaction, and is a spirilloicide.

β -Diethylaminoisohexyl *p*-aminobenzoate. P. KARRER. U. S. 1,555,217, Sept. 29. This compd. is made by reacting on $\text{Me}_2\text{CHCH}_2\text{CH}(\text{NEt}_2)\text{CH}_2\text{OH}$ with $p\text{-O}_2\text{NC}_6\text{H}_4\text{COCl}$ and reducing the resulting product. It is similar in effect to cocaine and has a stronger action than "novocaine."

Hydroxy- and alkoxyacridinium compounds. L. CASSELLA & Co., Ges. Brit. 218,542, Oct. 30, 1923. Hydroxy- and alkoxyacridinium compds. are prepd. by treating hydroxyacridines described in Brit. 217,715 (C. A. 19, 380) with alkylating or aralkylating agents in the absence of an acid-binding agent. E. g., 3,6-dihydroxy- and 3,6-dimethoxy-10-methylacridinium chlorides are prepd. by treating the corresponding acridines with *p*-toluenesulfonic methyl ester and boiling the toluenesulfonates with HCl to obtain the methochlorides. Ethyl-, benzyl- and hydroxy-ethyl-acridinium chlorides are obtained by treating 3,6-dimethoxyacridine with *p*-toluenesulfonic ethyl ester, benzyl chloride and ethylene chlorohydrin, resp. The alkylations are carried out in PhNO_2 soln. The products are antiseptics and show but little dyeing properties.

Diacetoxymercuri-4-nitro-*o*-cresol. G. W. RAIZISS. U. S. 1,554,293, Sept. 22. $\text{C}_6\text{H}_4(\text{OH})(\text{NO}_2)(\text{HgOAc})_2$ is made by dissolving 4-nitro-*o*-cresol in a hot aq. NaOH soln. and reacting on it with a hot acid $\text{Hg}(\text{OAc})_2$ soln., pptg. with NaOH. It is a brownish yellow powder insol. in H_2O , MeOH and ether, but sol. in a dil. aq. alkali metal hydroxide soln. It is a therapeutic germicide.

Compound of cinchona alkaloid with 2-phenylquinoline-4-carboxylic acid. H. W. RHODEHAMEL. U. S. 1,353,266, Sept. 8. Quinine or other cinchona alkaloid and 2-phenylquinoline-4-carboxylic acid are united in mol. proportions, e. g., by mixing the solns. in alc. together and crystg. The resulting compd. (with quinine) m. 174° .

Mercury derivatives of phthaleins. E. C. WHITE. U. S. 1,549,942, Aug. 18. HgO is caused to react in aq. suspension on a sol. salt of a phthalein, e. g., the Na salt of phenolphthalein or fluorescein, thus forming a product which may be used by injection as an anti-syphilitic.

Calcium salt of the organic phosphorus compound contained in milk casein. S. POSTERNAK. U. S. 1,555,517, Sept. 29. A white powder of "indifferent" taste, sol. in H_2O and contg. P 4.5–5, Ca 10–11 and N about 11.5%, is obtained by digesting milk casein with trypsin in a dil. NH_3 soln. until sepn. of fatty acids occurs, pptg. the filtered digestion liquid with a sol. Ca salt and about an equal vol. of alc., redissolving the pptd. Ca salt of the P compd. thus obtained in H_2O , repptg. with alc. and drying. This compn. is adapted for therapeutic uses.

"Face pack" composition. E. C. GOODE. U. S. 1,550,026, Aug. 18. A mixt. of K alum 2.5–3.5, casein 0.5–1.5 and oat-flour 18–22 parts is used with H_2O as a plastic pack for application to the skin to prevent or reduce wrinkles.

Tobacco. J. RAE. Brit. 231,355, June 16, 1924. Tobacco is "dressed" by treating it with steam "generated from an aq. soln. of KMnO_4 " in a rotating drum plated internally with Ni and provided with internal projections or spikes.

Apparatus for drying tobacco, etc. E. K. VIETOR. U. S. 1,555,779, Sept. 29.

Impregnating cut cigaret tobacco with an alcohol solution of menthol. L. F. HUGHES. U. S. 1,555,580, Sept. 29.

18—ACIDS, ALKALIES, SALTS AND SUNDRIES

FRED C. ZEISBERG

Synthetic ammonia: applications and manufacturing processes. F. LAMEY. *Bull. soc. ind. Mulhouse* 91, 410–31(1925).—Description and comparison of the Haber, Claude, Fauser and Casale processes. A. PAPINEAU-COÛTURE

Potash. J. W. TURRENTINE. *Mineral Ind.* 33, 591–9(1924).—A statistical review of production and trade. A. BUTTS

Should we have a potash industry? *Chem. Met. Eng.* 31, 14–5(1924).—What will potash cost the farmer? *Ibid* 31, 191–2. Future sources of potash and ammonia. *Ibid* 32, 284(1925). Potash readily obtainable from American sources. J. W. TURRENTINE. *Mfgs. Rec.* 87, 69–70; *Chem. Record Age* 23, 6–7(1925). E. J. C.

Sodium salts. A. G. WIKOFF. *Mineral Ind.* 33, 650–61(1924).—Discusses production of nitrate, NaCl, and other salts, with statistics. A. B.

Borax. T. R. LEIGHTON. *Mineral Ind.* 33, 6–9(1924).—A discussion of sources, production, and uses. A. B.

Magnesite. W. E. DORNBACH. *Mineral Ind.* 33, 460–71(1924).—Discusses classification, sources, production, trade and Mg metal, with a bibliography. A. B.

- Sulfur, pyrite and sulfuric acid.** A. E. WELLS. *Mineral Ind.* **33**, 662-74(1924).—Production, imports, uses and technology are reviewed. A. B.
- Antimony.** K. C. LI. *Mineral Ind.* **33**, 51-62(1924).—Discusses the shortage of Sb, also production in China and other countries and the Sb market. A. B.
- Arsenic.** V. C. HEIKES. *Mineral Ind.* **33**, 63-70(1924).—Supplies, production and prices are discussed. A. B.
- Barium and strontium.** ANON. *Mineral Ind.* **33**, 88-93(1924).—Sources and production of barytes and Ba and Sr chemicals are treated. A. B.
- Chromium.** W. D. JOHNSTON, JR. *Mineral Ind.* **33**, 119-28(1924).—Reviews technology, trade, production and prices of chromite and Cr chemicals. A. B.
- Selenium and tellurium.** S. SKOWRONSKI. *Mineral Ind.* **33**, 646-9(1924).—A review of uses and production, with bibliography. A. B.
- Iodine.** T. R. LEIGHTON. *Mineral Ind.* **33**, 100-1(1924).—Production in Chile and other countries, sources and uses are treated. A. B.
- Monazite.** S. J. JOHNSTONE. *Mineral Ind.* **33**, 501-5(1924).—Gives data on production, sources, trade and Th compds. A. B.
- Mica.** W. M. MYERS. *Mineral Ind.* **33**, 490-7(1924).—Classification and uses, production, market and imports and exports are discussed. A. B.
- Talc and soapstone.** R. B. LABOO. *Mineral Ind.* **33**, 675-80(1924).—A review of the industry, with statistics. A. B.
- Graphite.** BENJ. L. MILLER. *Mineral Ind.* **33**, 354-60(1924).—The industry in the United States and foreign countries is covered. A. B.
- Fluorspar.** H. W. DAVIS. *Mineral Ind.* **33**, 259-63(1924).—Covers production, consumption, imports and uses. A. B.
- Cryolite.** ANON. *Mineral Ind.* **33**, 254-5(1924).—Gives data on production and imports. A. B.
- Phosphate rock.** WM. H. WAGGAMAN. *Mineral Ind.* **33**, 559-73(1924).—Gives data of world production and notes on technology. A. B.
- Gypsum.** F. A. WILDER. *Mineral Ind.* **33**, 361-7(1924).—Statistics and discussion of production in the U. S. and other countries. A. B.
- Feldspar.** A. S. WATTS. *Mineral Ind.* **33**, 256-8(1924).—Statistics and discussion of production are given. A. B.
- Fuller's earth.** HERMAN GUNTER. *Mineral Ind.* **33**, 264-5(1924).—Data on production and imports are given. A. B.
- Asbestos.** OLIVER BOWLES. *Mineral Ind.* **33**, 71-80(1924).—An account of properties and uses, production and trade, with a bibliography. A. B.
- The new oxygen plant of the "Terres Rouge" Mining Co. at Belval.** MARCEL STEFFES. *Z. kompr. flussige Gase* **24**, 81-6, 97-100(1925).—Detailed description of a liquid-air fractionating plant employing the Linde process. R. I. DODGE
- The oxygen plant of the Siemens-Schuckert dynamo factory.** *Z. kompr. flussige Gase* **24**, 20-2(1925).—Description of a liquid-air fractionating plant using the Heylandt process. R. I. DODGE
- Silicate of soda as an adhesive.** REX FURNESS. *Ind. Chemist* **1**, 197-200(1925). cf. *C. A.* **17**, 326; **19**, 1018.—Variations in compn. and properties lead to many uses for Na silicates. Their solns. are used as adhesives in the manuf. of fiber board, veneers, asbestos products, abrasive wheels, and non-slip iron steps. WM. STERICKER
- The microscopical examination of chemical products. II.** C. H. BUTCHER. *Ind. Chemist* **1**, 381-2(1925); cf. *C. A.* **19**, 3181.—A comparison of gas black and lamp-black under the microscope is made. Carbon blacks giving a "short" ink can be easily and quickly distinguished from those giving a "long" ink. Long blacks can be converted into short blacks by treatment with steam at 500° and short blacks into long blacks by the introduction of some volatile impurity, such as tannin, in the form of a dil. alc. soln. two slides. E. G. R. ARDAGH
- Casein and its industrial applications.** F. C. C. LYNCH. *Can. Chem. Metallurgy* **9**, 203-5, 221-5(1925).—Attention is directed to the general uses of casein, the production, imports and exports of casein for Canada, the nature of the competition to be met and the general business conditions to be taken into account by the Canadian producer of casein. The natural sour or lactic acid process and the HCl or H₂SO₄ process are briefly outlined, while the renet method is set forth in some detail. Some attention is given to the economics of drying casein. A few of the more or less recent patents relating to the prepn. of casein are listed. The variations in casein, analyzed costs of manuf., transportation and selling fluctuations in prices, by-products, applications of casein in the paper industry, casein adhesives, casein plastics and casein paints are dealt with. List of patents. E. G. R. ARDAGH

A new process for the economical production of plastic materials from organic binding agents and powders, chiefly inorganic, insoluble in them. E. R. BESEMFELDER. *Chem.-Ztg.* 49, 747-8(1925).—The filling powder is treated with a current of an org., neutral, water-repelling fluid which does not decompose upon boiling, until every trace of moisture has been removed. The solvent is recovered in a condenser, and the dried powder is mixed intimately with the viscous org. binding agent, either alone or dissolved in some mobile org. liquid. Benzene, toluene, turpentine, CCl_4 and Cl-substituted hydrocarbons serve well in this process. W. C. EBAUGH

Carbonaceous material for absorption or catalysis (Brit. pat. 231,863) 21.

Sulfuric acid. H. PETERSEN. Brit. 231,853, April 1, 1924. Oxidation of SO_2 is effected by bringing the SO_2 into intimate contact with nitrosylsulfuric acid and other NO compds. dissolved in concd. H_2SO_4 , the oxidation being effected without liberation of gaseous N oxides. Kestner's atomizers, Schmiedel's rollers or Keller's sprayers may be used.

Sulfuric acid. G. F. HURT ENGINEERING CORPORATION. Brit. 231,921, Dec. 11, 1923. In the manuf. of H_2SO_4 by the nitration process, interaction between the liquids and gases is obtained by projecting the liquids into the progressing gases in successive fountains of drops which are of sufficient size that they are not carried away by the gas stream. An app. and details of operation are described. Cf. C. A. 19, 563.

Sulfuric acid. LODGE-COTTRELL, LTD. Brit. 231,536, March 31, 1924. The roaster gases cooled during elec. purification from dust and As are reheated to the proper temp. before admission to the chambers, by the heat evolved in a denitrating device.

Arsenic acid. C. G. RICHARDSON. U. S. 1,554,371, Sept. 22. Na arsenate or other sol. arsenate is treated with $\text{Fe}_2(\text{SO}_4)_3$ and the resulting insol. arsenate is then treated with H_2SO_4 to produce arsenic acid.

Drum for transporting hydrofluoric acid. R. M. MEIKLEJOHN. U. S. 1,553,321, Sept. 15. Metal barrels or drums which are preferably formed of steel are provided with an inner "passification crust" by filling the drum to about 90% its capacity with HF of about 58% strength and allowing it to stand for about 48 hrs. at a temp. of about 27° and then for 7 hrs. at about 60° while atm. pressure is maintained by means of a ventilating bung.

Ammonia; carbon monoxide; hydrocyanic acid. NORSK HYDROELEKTRISK KVAELSTOFAKTIESELSKAB. Brit. 231,134, March 21, 1924. The H_2O required for the production of NH_3 and CO by the catalytic decomp. of HCN present in gases which also contain H is produced *in situ* at an elevated temp. by introducing a gas contg. O. If air is used, the process may be combined with HCN manuf., the gases, after absorption of NH_3 and addn. of hydrocarbons or carbonaceous material being blown through an *elc.* arc. H may be added, if present in insufficient amt. in the original gases used. Cf. C. A. 19, 2392.

Ammonia synthesis. L. CASALI. Brit. 231,417, March 29, 1924. Reaction gases for catalytic NH_3 synthesis are purified by a preliminary treatment with NH_3 (preferably that from a previous catalysis) in excess of the amt. required to form solid compds. with C oxides, H_2S , NO and acid compds. present.

Nitrogen for ammonia synthesis, etc. COMPAGNIE DE PRODUITS CHIMIQUES ET ELECTROMETALLURGIQUES ALAIS, FROGES, ET CAMARGUE. Brit. 232,185, April 14, 1924. A mixt. of N and H free from O and suitable for NH_3 synthesis is obtained from products of combustion with slight excess of air of coke-oven gas, "lighting gas," "poor gas" or similar gases. Excess O is removed by treatment with H at high temp. and CO_2 may be absorbed in NH_3 soln.

Cyanides of the alkali metals. P. COMMENT and D. HATT. U. S. 1,555,944, Oct. 6. Ca cyanamide, CaC_2 and alkali metal carbonate, e. g., Na_2CO_3 , are heated together in equimol. proportions to produce a substantially quant. yield of NaCN (or other cyanide). A temp. of about 500° may be employed.

Alkali aluminates. K. FLOR, T. LICHTENBERGER and SALZWERK HEILBRONN AER.-GES. Brit. 231,147, March 19, 1924. A mixt. of alkali metal chloride, e. g., NaCl and Al_2O_3 , in the resp. mol. proportions of 6 to 1, is treated with steam at 500 – 600° , forming a porous aluminate and HCl. A salt of Mn, Cu, Cr or Mg may be added as a catalyst. The aluminate may be decomposed with CO_2 to produce alkali carbonate and Al_2O_3 and the latter used to react with more alkali chloride.

Ammonium sulfate. SOC. DES FOURS A COKE SEMET SOLVAY ET PIETTE, SOC.

ANON. Brit. 231,788, Dec. 30, 1924. Crude NH_4 sulfate crystals, after draining, are washed with successive satd. solns. of NH_4 sulfate, each of greater degree of purity than that previously used. The excess of washing liquor (after employment in cyclic succession) is returned to the saturator and the crystals are given a final washing with NH_4 sulfate soln. preferably rendered alk. by addn. of NH_3 , or of NH_4 carbonate or bicarbonate. An app. is described.

Aluminium sulfate. H. WRIGLEY. Brit. 230,916, Dec. 19, 1923. Aluminous materials such as shales, fireclays or blaes which do not disintegrate during leaching are leached as a mixt. of fines and coarser material. The soln. obtained is submitted to a settling process at $55-65^\circ \text{Tw.}$ and the clear liquid is concd. and crystd.

Sodium perborate. DEUTSCHE GOLD UND SILBER SCHEIDEANSTALT VORM. ROESSLER AND O. LIEBKNECHT. Brit. 231,945, Jan. 11, 1924. CO_2 is passed into a reaction mixt. of Na peroxide, H_2O and H_3BO_3 or alkali borates so as to leave a Na_2CO_3 soln. contg. some NaHCO_3 . To the mother liquor, more Na peroxide and H_3BO_3 or borate is added and NaHCO_3 also may be added. Silicates, phenols, etc., may be added as stabilizing agents.

Basic lead sulfate. B. S. WHITE. U. S. 1,555,538, Sept. 29. By-products recovered in the smelting of Pb ores or similar materials and contg. a large proportion of basic Pb sulfate are projected in finely divided form into a highly heated furnace which is simultaneously supplied with SO_2 and air to produce a basic Pb sulfate of the desired degree of basicity.

Recovery of cadmium as sulfate. M. F. COOLBAUGH and J. B. READ. U. S. 1,552,595, Sept. 8. Materials such as flue dusts which contain both As and Cd are roasted with H_2SO_4 and Fe_2O_3 or other ferric compds. to produce CdSO_4 and a ferric arsenate from which the CdSO_4 may be readily leached with H_2O .

Recovery of cadmium as sulfate. J. B. READ and M. F. COOLBAUGH. U. S. 1,552,506, Sept. 8. Flue dust or similar material contg. both As and Cd is roasted with Fe pyrites and H_2SO_4 or other Fe-contg. sulfate-forming material to produce CdSO_4 .

Recovering fluorspar, etc., from waste dumps. G. M. JACKSON and CLAY CROSS CO., LTD. Brit. 231,575, Jan. 1, 1924. Mech. features of fluorspar, etc., recovery from waste dumps of Pb mines or similar wastes.

Potassium values from residues of molasses fermentation or other organic waste materials. H. A. NIBECKER. U. S. 1,555,512, Sept. 29. Fermentation or sugar extrn. residues or other similar org. waste materials are reduced to ash form by slowly conveying them through an enlarged passage in contact with a heated gaseous medium such as combustion gases to dry them and then initiating and propagating combustion of the dried material in a passage of smaller diam. U. S. 1,555,513 relates to a rotary kiln adapted for use in this process.

Separating calcined colmanite from clay, etc. H. D. HELLMERS. U. S. 1,556,110, Oct. 6. Centrifugal action, baffling and suction are employed. An app. is described.

Quick-setting hydrated lime containing aluminium fluoride. M. E. HOLMES and G. J. FINK. U. S. 1,554,183, Sept. 15.

Quick-setting hydrated lime containing zeolites. M. E. HOLMES and G. J. FINK. U. S. 1,554,184, Sept. 15.

Fixing nitrogen. J. C. CLANCY. U. S. 1,550,202, Oct. 6. A counter current flow of molten Na_2CO_3 and air and natural gas or other gas contg. both N and hydrocarbon is maintained through a fixed porous catalytic mass comprising nitrides of Ta, Cr, Th, Ti and Mn, to produce cyanide.

Hydrogen. BADISCHE ANILIN & SODA FABRIK. Brit. 231,218, Nov. 26, 1923. H or a mixt. of H and N (adapted for making synthetic NH_3) is produced by igniting hydrocarbons in the gaseous phase with O or air (both being preferably preheated), then oxidizing the CO in the product to CO_2 by steam in the presence of a catalyst such as Fe oxide and finally removing the CO_2 . Coke-oven gas may be used as a starting material.

Hydrogen and oxygen from water. SYNTHETIC AMMONIA AND NITRATES, LTD. Brit. 232,431, May 29, 1924. H_2O is decomposed by the action of Hg which may be used in vapor form with H_2O vapor. The Hg oxide formed is regenerated in a cyclic operation.

Apparatus for producing hydrogen by the iron-steam process. COMPAGNIE DE PRODUITS CHIMIQUES ET ELECTROMETALLURGIQUES ALAIS, FROGES, ET CAMARGUE. Brit. 232,184, April 11, 1924.

Colloidal sulfur. C. C. LOOMIS and H. E. STUMP. U. S. 1,549,886, Aug. 18. Rosin soap or other colloid is added to a soln. of an alkali metal polysulfide or other

polysulfide of a non-volatile base, the soln. is acidified, *e. g.*, with gaseous SO_2 , and the pptd. S is recovered by filtering and washing.

"Free-burning" sulfur. J. W. SCHWAB. U. S. 1,556,037, Oct. 6. Aniline, diphenylamine or other org. compd. sol. in molten S is added to the latter to improve its burning properties. The S may contain oil as an impurity.

Decolorizing carbon. L. L. HAMON and ARTIFICIAL COAL CO. (HANON PROCESS), LTD. Brit. 231,935, Jan. 9, 1924. The H_2O content of peat, lignite, sawdust or similar material is reduced to 25–35%, and after grinding and treatment with $\text{Ca}(\text{OH})_2$ to facilitate disintegration, the material is carbonized and treated with steam, CO_2 , H or Cl and then with hot acidulated H_2O .

Decolorizing carbon. H. MÜLLER-CLEMM and GES. FÜR CHEMISCHE PRODUKTION. Brit. 218,628, July 5, 1923. The process of Brit. 216,130 (*C. A.* 19, 156) for prepg. decolorizing C by carbonizing a mixt. of sulfite cellulose soln. or similar material and alkali sulfides with or without alkali carbonate is modified by the introduction of CO_2 to form carbonate in the soln. The ppt. is removed and the soln. then evapd. to dryness and carbonized. $\text{Ca}(\text{OH})_2$ is added to sulfite cellulose soln. and the filtered ppt. is leached with hot K sulfide soln., the Ca pptd. with CO_2 and the soln. treated as before.

Decolorizing carbon. H. M. SHILSTONE. U. S. 1,556,039, Oct. 6. Fibrous rice material such as hulls, straw or chaff is partially burned to a charred mass and then treated with alkali, *e. g.*, with NaOH soln., to produce a porous material and leave a product free from resinous substances.

Argon and lead oxide. P. E. HAYNES. U. S. 1,555,570, Sept. 29. A gaseous mixt. contg. O and A in proportions greater than in atm. air is brought into contact with Pb maintained at a temp. above its m. p.

Shaped articles of metal oxides. N. B. PILLING. U. S. 1,553,394, Sept. 15. Filaments for thermionic devices or other articles are shaped from metals such as Ni with a Ca coating and then slowly oxidized in dry O.

Hardening gelatin or other colloids. AKT.-GES. FÜR ANILIN-FABRIKATION. Brit. 231,564, Dec. 10, 1923. Gelatin or other colloid is successively mixed with or treated with non-hardening agents which together exert a hardening action; *e. g.*, dichromate may be used in conjunction with ferrous NH_4 sulfate, hydroquinone, or Na formaldehyde-sulfoxylate, or formaldehyde bisulfite may be used with alkali.

Catalysts. BENZONAFTENE. Brit. 231,458, March 26, 1924. Na formate is added to catalytic materials such as Fe, Ce or Th oxides, reduced Fe or Ni or other "heavy" or "rare" metals having a m. p. above 550° , in order that, when heated, the nascent H produced from the formate may further activate the catalyst.

Catalysts. A. T. LARSON. U. S. 1,555,505, Sept. 29. A composite promoter comprising an oxide of Zr and an oxide of a relatively basic element such as K_2O is used with catalysts such as Fe oxide in the manuf. of NH_3 from N and H.

Fused oxide catalysts. A. T. LARSON. U. S. 1,554,008, Sept. 15. In making a fused oxide catalyst, adapted for NH_3 synthesis, a bed of material such as Fe oxide from which the catalyst is to be formed is heated by electrodes to fuse a portion of the material.

Absorbents for gases. GES. FÜR CHEMISCHE PRODUKTION. Brit. 231,466, March 25, 1924. Gases or vapors are absorbed by active charcoal obtained by carbonization in the presence of alk. salts such as K_2CO_3 , K sulfide or K polysulfide and are recovered after absorption by distn. *in vacuo* or with steam. The charcoal may be prepd. as described in Brit. 216,130 (*C. A.* 19, 156) and Brit. 218,628 which specifies modifying the process of Brit. 216,130 (especially in using sulfite cellulose lye) by introducing the carbonate in the form of CO_2 , which may, *e. g.*, be passed into a mixt. of sulfite cellulose lye and K sulfide, the ppt. being sepd. by filtration and the filtrate evapd. to dryness and carbonized.

Using chemical reagents on porous carriers. AKT.-GES. FÜR CHEMIEWERTE. Brit. 231,901, April 5, 1924. Acids or other reagents for nitration, sulfonation, oil purification and other reactions are mixed with a porous substance such as bone black, fuller's earth or burnt kieselguhr. *E. g.*, PhNO_2 may be made by treating C_6H_6 on the water bath with HNO_3 absorbed in kieselguhr. Numerous other examples are given.

Polishing glass. W. TAYLOR, F. W. PRESTON and KAPPELLA, LTD. Brit. 230,882, Oct. 18, 1923. A mixt. of resin or pitch with a smaller quantity of beeswax, Japan wax or carnauba wax is used for satg. felt, cloth or other fibrous material for polishing glass.

Cleaning lenses. C. H. OHLWILER. U. S. 1,556,248, Oct. 6. Blocking compd. such as that formed from pitch is removed from lenses by a solvent bath of heavy coal tar distillate, the residue of this solvent is removed by an acid bath, *e. g.*, H_2SO_4 , and the lenses are freed of the acid bath by washing with H_2O .

Composition for dispersing rain drops on glass, etc. O. HEIDEMANN and M. JOHN. U. S. 1,555,852, Oct. 6. A mixt. of clay, H_2O and soda.

Metal polishes. H. A. SCRIVEN and B. F. G. GUISSA. Brit. 232,034, April 11, 1924. Tripoli powder 1.5 oz. is mixed with gasoline 1 pint and oil of mirbane 1 dram.

Cleaning aluminium. P. P. BAILEY and E. M. BAILEY. U. S. 1,554,483, Sept. 22. Al is placed in a soln. contg. an oxalate, acetate or a similar compd. of an org. acid and sugar, starch, gums or other carbohydrate-supplying material, boiled in the soln., removed and washed.

Detergent for cleaning aluminium ware. M. M. WILSON. Brit. 231,987, Feb. 26, 1924. Citric acid or acid Ca citrate is mixed with pumice, with or without $CaCO_3$.

Polishes for leather, linoleum, wood, etc. J. SCHWARZKOPF. Brit. 231,774, July 8, 1924. Coffee wax (a wax-like material extd. from coffee or coffee husks and obtained in the manuf. of caffeine-free coffee) is used to the extent of $1/2$ -3% together with other waxy materials, dyes, etc.

Mixture for cleaning and polishing wood, metal or other surfaces. M. OKAMURO. U. S. 1,555,149, Sept. 29. Furfural 2 qts., gasoline 2 qts., "ammonia" 0.1 gal., carbolic acid 2 oz., vinegar 1 gal., soap 6 lbs. and H_2O $1\frac{1}{2}$ gals.

Polish for furniture, automobiles, etc. B. H. WRIGHT. U. S. 1,550,137, Aug. 18. Bofax, 1 oz., is mixed with wax 4 oz., oil 2 pints and H_2O 3 qts.

Backing for stencil sheets. H. E. SMITH. U. S. 1,550,330, Aug. 18. Stencil sheets are backed with sheets of manila jute paper or other flexible material carrying a H_2O -repelling coating which may comprise varnish or shellac and an overlying coating of yielding and preservative material such as paraffin.

Mixture for cleaning straw hats. C. POSLUSZNY. U. S. 1,550,044, Aug. 18. Powd. chalk 0.24, oxalic acid 0.94, SO_2 47, Pb acetate 0.47, "salts of lemons" 0.24, Na hyposulfite 0.94 and H_2O 96.7 parts.

Packing mixture. M. P. EBBESEN. Brit. 231,154, March 18, 1924. See Danish 33,931 (C. A. 19, 1477).

Packing for reaction towers. H. W. SCHAFER. Brit. 231,199, March 24, 1924. Fillers for absorption, reaction or distg. towers are formed of spirals of sheet metal or rolled wire.

Electrostatic and mechanical separation of asbestos from non-fibrous gang. G. H. HORNE. U. S. 1,549,875, Aug. 18.

Phenol aldehyde condensation product. G. W. MILES. U. S. 1,549,888, Aug. 18. Condensation is effected in the presence of $SnCl_2$ which serves to initiate a vigorous reaction such that cooling is preferably employed.

Plastic composition. W. HOSKINS. U. S. 1,556,115, Oct. 6. A phosphatic material such as bone ash or phosphate rock is admixed with H_2SO_4 and an aluminate binder, e. g., Na or Ca aluminate to form a compn. suitable for molding.

Plastic compositions. WESTERN ELECTRIC CO., LTD. Brit. 231,781, Nov. 28, 1924. Fused silica is degasified (for use as a filler in plastic compns. of the kind described in Brit. 182,422 (C. A. 16, 4308)) by heating it for at least an hr. to a temp. slightly below its sintering point, e. g., to about 900-1000°.

Plastic composition adapted for making molded boxes, etc. C. JAEGER. U. S. 1,553,820, Sept. 15. A compn. adapted for molding under heat and pressure comprises sawdust 80, straw waste 20, coal ashes 50, corn starch 10-15, Fe chloride 10, H_2O 20, rosin 2 and lithopone $1/2$ part.

Separating constituents of fibrous thermoplastic mixtures. H. P. SHOPNECK. U. S. 1,555,763, Sept. 29. Mixts. such as those contg. fibers and rosin or bitumen from box toe stock are disintegrated in the presence of H_2O to render the binder suspendable in the H_2O so that it can be sepd. from the fibrous material. After its sepn. it is heated to facilitate its sepn. from the associated H_2O .

Casein compositions. W. H. SIMMONS and BRITISH XYLONITE CO., LTD. Brit. 232,071, March. 15, 1924. In forming plastic compns., a small proportion of an aq. emulsion of rubber or latex is added to the casein which is then worked up in the usual way.

Moldable compositions. G. PETROFF. Brit. 231,431, March 25, 1924. Oxycellulose (with or without gypsum or other substances) together with an acid catalyst is added to the liquid reaction product obtained by warming phenol and formaldehyde together without a catalyst, and the mixt. is molded and heated to harden the products.

Molded fiber articles. C. C. LOOMIS and H. E. STUMP. U. S. 1,552,625, Sept. 8. Wood, leather or other fiber is treated with natural latex, partially coagulated, e. g. by HOAc or alum, and then molded.

Forming molded receptacles or other products from pulps. H. BUEL. U. S. 1,549,903, Aug. 18. A fluent pulp is forced under superatm. pressure against a foraminous mold wall and an inert gas such as N, neon or CO₂ is forced under pressure to deposit the materials remaining suspended in the supply conduit after the supply has been cut off. A further supply of heated inert gas serves to dry the material in molded form.

Shoe lasts of molded material. E. L. AIKEN. U. S. 1,550,232, Aug. 18. A rough shape of paper pulp is formed in a mold, the H₂O is dried out, and it is then impregnated with a liquid binder such as a "carboloid" compn. capable of undergoing a chem. change which will render it semi-flexible at normal room temp. The mass is then pressed to semi-finished shape, heated to produce the desired change in the binder, machined to size, coated with "carboloid" and polished.

Mat surfaces on transparent material. C. E. SWERT. U. S. 1,549,814, Aug. 18. A soln. of CaCl₂ is applied to "window envelopes" or other transparent material and, on evapn., leaves a deposit giving a mat surface.

Lining metal pipes. B. TALBOT. U. S. 1,555,257, Sept. 29. A fluid mixt. of hydrocarbon material and powdery reinforcing material, e. g., a mixt. of pitch and granite chippings, is applied as a lining to pipe which is rapidly rotated until the lining mixt. has set.

Acoustic diaphragms. F. A. E. JENKINS. Brit. 232,394, March 24, 1924. See U. S. 1,511,166 (C. A. 18, 3689)

Firelighters. S. SAMSOG. Brit. 231,829, April 7, 1924. Cardboard, sawdust, paraffin, charcoal and KClO₃ are specified.

19—GLASS, CLAY PRODUCTS, REFRACTORIES AND ENAMELED METALS

G. E. BARTON, C. H. KERR

The manufacture of semi-opaque glasses. H. V. RENN. *Ind. Chemist* 1, 383-5 (1925). Opacification results from colloidal sepn. in a glass due to the introduction of such substances as oxides of Sn, Zn, Al, Ti, Zr, Sb and As, Cu₃(PO₄)₂, BaCO₃, asbestos, china clay, feldspar, cryolite, fluor spar, fluosilicates, and salts such as sulfates, chlorides and bromides. Generally compds. contg. Al are used in conjunction with fluorides and fluosilicates. "Opalescent" glass is transformed to "alabaster" glass when sufficient chlorides and sulfates have been added to increase the size of the suspended particles until white light is transmitted. Various ways in which opacification can be brought about or regained are described and the quantities of the substances used are given.

E. G. R. ARDAGH

The viscosity and allotropy of glass. HENRY LECHATELIER. *Ann. phys.* 3, 5-21 (1925).—See C. A. 19, 2114.

R. H. LOMBARD

Thermotechnical investigations of glass furnaces. I. Heat flow in a Siemens-step-grate generator. G. GEHLHAFF, O. RICKLEFS AND W. SCHREIBER. *Z. tech. Physik* 6, 278-87 (1925). The thermal efficiency of an open, step-grate Siemens generator, using coarse lignite, referred to its upper heating value is about 65%. In the heat balance, Langbein's formula ($H = 85 C + 270 H + 25 S - 25.5 O$) together with the elementary analysis of the fuel is used to det. calorific value. **II. The gasification of lignite in a Siemens-step-grate generator.** *Ibid.* 338-51.—Numerous measurements of the temp. and numerous gas analyses at different depths of the charge of a Siemens-step-grate generator have been made. The analysis of the lignite used together with other data lead to diagrammatic representations of the temp. distribution and the distribution of CO and CO₂ in the generator for different operating conditions. The following balances have been made on the operations: CO₂; air-N₂; S; H₂O-H₂; O₂ and heat balances.

J. H. PERRY

The preparation of coppered glass mirrors. E. A. H. FRENCH. *Trans. Optical Soc. (London)* 25, 229 (1924); *J. Soc. Glass Tech.* 9, No. 33, 34-5.—The phenylhydrazine method of Chattaway (C. A. 2, 1517) for prep. Cu mirrors from aq. solns. of Cu salts was found by F. to give satisfactory results only on interior curved surfaces. Plane surfaces could not be coated satisfactorily because of contamination with the tarry by-products formed. Better results were obtained with hydrazine sulfate. In the method finally adopted, the glass to be coppered was fastened to the under side of a Cu float capable of suffering rotation in the coating bath, which in its turn was kept at the desired temp. by a hot water bath. The glass was cleaned with concd. HNO₃, washed,

immersed for 1 hr. in 1% KOH soln., washed well first with tap and then with distd. water. The surface was then polished with a clean dry cloth, quite grease-free, and the glass fixed to the float. The coating bath was made up as follows: 9 g. of hydrazine sulfate were dissolved in 150 cc. of distd. water and heated at 60°, and to this was added, with const. stirring, 90 cc. of a satd. soln. of Cu hydroxide and NH_3 at 16°, the resulting mixt. being a clear yellow color. The glass was then sponged over with the mixt., this being a most necessary step in the process. To the soln. was then immediately added slowly and with const. stirring 87.5 cc. of a soln. at 60° of 11.1 g. of pure KOH in 100 cc. of water. The solns. should still be of a yellow color without any pptn. taking place. The mixt. was then poured into the coating vat (of Cu) standing in the hot water bath at 43°, and the glass on the float at once immersed and the float periodically rotated. The temp. of the bath was then very gradually raised to 57° over a period of about 20 min. for the first 15 of which the bath turned a dark green color before finally acquiring a pink shade. After a further 5 min. the film was thickened by the addn. of a mixt. of 50 cc. of the Cu hydroxide- NH_3 soln. at 16° with 10 cc. of the KOH at 60°, the temp. of the bath being dropped to 43° before the addn. The float was removed during the addn. and stirring of the mixt., and was quickly replaced and the same heating schedule followed. Further reinforcements of the coat could be obtained by repetitions of the above, and by electroplating from a bath made by boiling 1 part of K bitartrate with 10 parts by weight of water and adding as much hydrated Cu carbonate as would dissolve. A safe c. d. was 0.25 amp./sq. dm. heavier currents tending to cause stripping of the film. The ordinary acid or cyanide plating baths were no good. The process was appreciably cheaper and safer than that using phenylhydrazine.

H. G.

Segregation (of ceramic materials) in bins. T. W. GARVE. *J. Am. Ceram. Soc.* **8**, 666-70(1925).

C. H. KERR

Talc as the principal body ingredient in vitrified ceramic bodies. H. M. KRANER AND S. J. McDOWELL. *J. Am. Ceram. Soc.* **8**, 626-35(1925).—"The prospect of bonding talcs with clay and firing the resulting compns. to vitrification is a doubtful possibility" except under very close temp. control. Compns. lying in the forsterite field seem more promising. The presence or addns. of small amts. of various RO constituents helps to lengthen the firing range.

C. H. KERR

The chemical and physical properties of fire clays from various producing districts. M. C. BOOZE. *J. Am. Ceram. Soc.* **8**, 655-65(1925).—Chem. analyses, fusion points and firing characteristics of a number of flint and plastic clays from various districts are given and uses discussed.

C. H. KERR

The mechanical, thermal and optical properties of fused silica. ELIHU THOMSON. *J. Franklin Inst.* **200**, 313-26(1925).—Clear fused silica can now be made in large masses reasonably free from bubbles by melting in a vacuum furnace and subjecting the fused mass to a high pressure during cooling. At 1750° SiO_2 begins to sublime rapidly. It has no m. p. Fused silica is like glass, hard, brittle, but more elastic and more transparent to ultra-violet and infra-red light as well as to the visible spectrum. Coeff of expansion is very low; at 200° it is 518×10^{-9} and changes very little up to 1000°. The n_D is 1.459. It is non-hygroscopic and is a good elec. insulator. Slow cooling or holding too long at about 1200° will cause crystal. and loss of its unique properties.

R. J. MONTGOMERY

Testing silica bricks. E. STEINHOFF. *Stahl u. Eisen* **44**, 1277-83(1924).—The methods of testing silica bricks at the Research Institute of the Dortmund Union are described with reference to 3 samples. The tests employed include a complete analysis, detn. of the m. p., true and apparent sp. gr., porosity, crushing strength at high temps., permanent expansion after prolonged heating, and percentage transformation of the quartzite into cristobalite and tridymite; the macrostructure and microstructure are also examd. The best bricks contain a min. of 95% SiO_2 , and m., 1710-1730°, and have a true sp. gr. of about 2.35. The sp. gr. decreases after heating for prolonged periods at 1500-1600° to this value even when the brick as delivered has a higher sp. gr., while the porosity also decreases. A well-fired brick will withstand a crushing strain of 3.5 kg. per sq. cm. up to over 1550°, and should become stronger with continual use at temps. about 1500°; after 24 hrs. at this temp. no further changes in length should take place, and in any case the increase in length after this firing should not exceed 2-3%. Photomicrographs are included to show the characteristic changes that take place in the microstructure after varying periods of firing.

B. C. A.

An X-ray study of cyanite and andalusite. J. T. NORTON. *J. Am. Ceram. Soc.* **8**, 636-9(1925).—Examn. by the X-ray diffraction method showed structures of cyanite and andalusite different from one another and from sillimanite. Upon heating, the

compsds. are converted into another form which gives the diffraction pattern of mullite or sillimanite. C. H. KERR

Differentiation between mullite and sillimanite by their X-ray diffraction patterns. L. NAVIAS AND W. P. DAVEY. *J. Am. Ceram. Soc.* 8, 640-7(1925).—The X-ray diffraction patterns of pure sillimanite and pure mullite are shown to be different. By X-ray methods it is shown that the cryst. component of calcined clays is mullite, not sillimanite, a conclusion in agreement with chem. and optical data found in the literature but not in accord with the negative results previously reported by several workers in X-ray crystallography. C. H. KERR

Some features of tank block comparisons. F. S. THOMPSON AND H. I. VORMELKER. *J. Am. Ceram. Soc.* 8, 611-7(1925).—Life of tank blocks is increased by lower furnace temps. obtained by increasing the area of melting chamber and by insulation of the walls. Analyses and phys. tests of clays and blocks are given; results of service tests are also given but "data do not warrant conclusions." C. H. KERR

The quantitative determination of iron existing as ferrosilicon in artificial corundum. R. A. HEINDL. *J. Am. Ceram. Soc.* 8, 671-6(1925).—Det. the total Fe by the combined acid treatment and KHSO_4 fusion. Det. the amt. of ferric oxide present by the fusion method with KHSO_4 . Subtract the Fe as ferric oxide from the total Fe and the difference is Fe present as ferrosilicon. Grains of artificial corundum examd. showed 0.070-0.171% Fe as ferrosilicon. The coarser grains contain more and the finer, less. C. H. KERR

The relation of structure and composition to thermal efficiency of refractories when used in regenerators. S. M. PHELPS. *J. Am. Ceram. Soc.* 8, 648-54(1925).—Lowering the porosity of checker brick increases thermal efficiency by reason of greater heat capacity, which is a function of wt. and sp. heat. Glazing a clay brick does not materially impair its efficiency, because the greater part of the heat leaves the surface of the brick by convection and this is affected only by the surface area, which is not changed by glazing. SiC is of little value for checkers because of its low thermal capacity. C. H. KERR

Abrasives. ANON. *Mineral Ind.*, 33, 1-10(1924).—A review of natural and artificial abrasives, with statistics. A. B.

Enameling defects due to cast iron. A. I. KRYNITSKY. *J. Am. Ceram. Soc.* 8, 618-22(1925).—Discussion of the effect of the amt. and condition of the C. C. H. KERR

Gas-fired enameling furnaces without muffles. H. H. CLARK. *J. Am. Ceram. Soc.* 8, 623-5(1925). C. H. KERR

Compressibility of several glasses (BRIDGMAN) 2. Qualities of firebrick (GRUM-GRZHIMAILO) 9. The stability relations of modifications in the polymorphous system, Al_2SiO_5 (NEUMANN) 2. Metal pins, etc., for joining artificial teeth or other ceramic materials (U. S. pat. 1,555,315) 9.

Glass-refining furnace. A. GRAUEL. U. S. 1,552,555, Sept. 8.

Glass-melting furnace. B. H. SCHIELDROP. U. S. 1,554,251, Sept. 22.

Pot for melting glass. H. SCHNITRPFEIL. U. S. 1,552,884, Sept. 8.

Annealing glass. J. BENNETT. U. S. 1,553,283, Sept. 8. Glass is annealed in a closed chamber from which air and gases are withdrawn to effect cooling in a partial vacuum.

Furnace for annealing glass. F. W. KNOWLES and KILNER BROS., LTD. Brit. 231,975, Jan. 31, 1924.

Vertical leer for annealing glassware. R. GOOD. U. S. 1,554,275, Sept. 22.

Ceramic articles. E. ANDERSON. U. S. 1,556,193, Oct. 6. In making ceramic articles such as emery wheels the materials are puddled and mixed with a temporary binding substance such as linseed oil, enclosed in a mold and heated in an oven sufficiently to cause the binding substance to unite the constituents of the mixt. This heating is continued until the puddle is dry, the puddle being subjected indirectly to air currents in the oven.

Kiln and mode of operation for salt glazing ceramic ware. C. DRESSLER. U. S. 1,556,208, Oct. 6.

Earthenware. H. OEXMANN. Brit. 231,469, March 27, 1924. In making earthenware, clay or the like is subjected to high pressure, e. g., 300 atm., either as a mass or in the form of shaped articles. The pressure may be exerted through a gaseous, liquid or powd. medium and to avoid penetration of the liquid the body may be coated with rubber or shellac soln. or treated with oil, fat or ceresite. Gypsum and cement articles may be similarly treated.

Silica-lime brick. C. MENDIUS. U. S. 1,554,639, Sept. 22. Granulated blast-furnace slag is mixed with a small proportion of lime and of granite, flint or other hard crushed material of high silica content, moistened and molded under high pressure and then cured for several hrs. with steam at high pressure.

Electric furnace adapted for firing fine pottery, etc. C. A. CADWELL. U. S. 1,555,401, Sept. 29.

Refractory brick. W. CROW and J. C. SCHAFFER. U. S. 1,553,143, Sept. 8. A refractory material adapted for use in paving or firebrick or in lining furnaces is prepd. by heating dolomitic limestone 86, clay 10, Fe ore 3 and orthoclase 1 part.

Refractory material. J. W. MARDEN and H. K. RICHARDSON. U. S. 1,554,225, Sept. 22. A layer of Th oxide is applied to the surface of fireclay bricks or other refractory materials to improve their resistance to high temps. The Th oxide may be mixed with ZrO_2 and double fluorides and H_2O to facilitate its application to the material as a coating. Cf. C. A. 19, 3359.

Refractory materials for repairing furnaces, etc. B. C. SELLARS. Brit. 231,650, March 11, 1924. Na silicate is dried and mixed with a refractory material such as Al_2O_3 , asbestos, gannister, or barytes and the mixt. is prepd. for use by addn. of H_2O .

Refractory cement. P. J. F. KESTNER. Brit. 231,141, March 21, 1924. A mixt. of bauxite 1-40 and aluminous cement 2 parts, with or without a refractory aggregate, is used for making and repairing furnaces, bricks, etc.

Bonded abrasive articles. P. JOHANSON and C. B. TILTON. U. S. 1,555,119, Sept. 29. Granulated corundum, Si carbide or other abrasive material is bonded with dry Na silicate and Na silicate in liquid form, and caused to set by heating without fusion. The silicate used constitutes over 10% of the total mixt.

Bonded abrasive articles. C. B. TILTON and M. F. BEECHER. U. S. 1,535,086, Sept. 29. Grains of emery, corundum, Si carbide or other abrasive material are mixed with dry Na silicate and with gum tragacanth or other temporary viscous binder, molded and heated to 850-1000°.

Binder for use with abrasives. H. R. POWER. U. S. 1,553,105, Sept. 8. A cement mixt. contg. $Ca(OH)_2$ and which may include port. cement is treated with CO_2 to convert the $Ca(OH)_2$ into $CaCO_3$ and produce a dense homogeneous product after being molded with admixed abrasives.

• **Oven or furnace adapted for heating enameled articles.** H. B. CANNON. U. S. 1,550,340, Aug. 18.

Enameling both sides of flat metal articles, etc., in tunnel kilns. C. DRESSLER. U. S. 1,552,475, Sept. 8. Mech. features.

Kiln for enameling ware. C. A. HAHN. U. S. 1,549,830, Aug. 18

20—CEMENT AND OTHER BUILDING MATERIALS

J. C. WITT

Cement. R. W. LESLEY. *Mineral Ind.* 33, 104-18(1924).—Production, prices, stocks, trade, technology and the foreign cement industry are reviewed. A. B.

Effect of the sulfide content on the properties of blast-furnace slags and cements. R. GRÜN. *Stahl u. Eisen* 45, 344-6(1925).—The m. pts. and the microscopical and hydraulic properties of fused mixts. contg. slags, both natural and synthetic, together with increasing proportions of CaS, were detd. A comparative series of tests substituting CaO and MgO for CaS, was also carried out. The results showed that a fairly high sulfide content is not injurious to cements; on the contrary, it increases the strength and does not induce rapid setting, as is often assumed. When present in small quantity, the CaS forms an eutectic with the silicates, is taken up by them into solid soln. at higher temps., and, on cooling, seps out in dendritic form. When present in large amt., it seps out in globular form. B. C. A.

Ground water corrosion of concrete. H. BRATKE. *Wasser u. Gas* 15, 444-6(1925).—B. reports the action of a ground water on an underground concrete structure. The high sulfate content of the water in contact with the concrete suggested the failure might be due to the formation of Ca Al sulfates. B. warns against placing concrete under ground without an examn. of the ground strata and the ground water. M. E. F.

Paving compositions having a rubber base for modern roads. ARNAUD. *Rev. gén. caoutchouc* 1925, No. 14, 12-4.—A description of the principal types of paving materials developed by de Caudenberg, viz., rubberized asphalt, elastic cement and colloidal macadam, all of which have been patented (cf. C. A. 16, 629; 17, 3787). C. C. D.

Report of Committee 4. Preservatives. L. C. DREFAHL, *et al.* *Proc. Am. Wood-Preservers' Assoc.* 1925, 47-77.—Data including service records and tests are presented for wood-tar creosote, low-temp. tar and 10 proprietary compds. including Aczol and Wolman Salts. A toxicity study of petroleum samples (gas oil fraction) from 42 sources shows that none was sufficiently toxic to be used alone as a wood preservative. A revision of the float test of residue in creosote is presented for adoption as standard. The Comm. proposes the substitution of a new flask with short neck and side tubulature for the retort now standard for creosote distillation. The standard methods for the volumetric and gravimetric analysis of ZnCl_2 are combined and slightly revised. No recommendation is made with reference to standard specifications and methods of analysis of petroleum for admixt. with creosote but chem. and phys. data are given of such mixts.

ALFRED L. KAMMERER

Report of Committee 5. Treatment. E. H. HORROCKS, *et al.* *Proc. Am. Wood-Preservers' Assoc.* 1925, 122-215.—Specifications for the treatment of the following classes of materials are presented: fir ties, piling, posts and cedar poles. The treatment of car material is discussed but no specifications are presented.

A. L. K.

Report of Committee XVII. Wood preservation, Appendix A. Revision of manual. HERMANN VON SCHRENK, *et al.* *Proc. Am. Ry. Eng. Assoc.* 1925, 65-75.—The Assoc.'s standard float test of residue remaining in the retort after distn is revised as to perfection of app. and method of procedure. A specification for a thermometer, 0° to 400° , is presented for adoption as standard for use in creosote distn. Standard methods for the analysis of ZnCl_2 , a volumetric one based on titration with K ferrocyanide with acetate as an external indicator and a gravimetric method based on the pptn. as sulfide in a weak H_2SO_4 soln. and ignition to ZnO are also presented. The Comm. suggests as a substitution for the glass retort now standard for creosote distn. a short-necked flask of the same capacity with a side tubulature. Such a flask is easier to obtain true to specified dimensions and it is claimed that it will yield results concurrent with those of the retort.

ALFRED L. KAMMERER

Report of Committee XVII. Wood preservation, Appendix B. Service test records. C. F. FORD, *et al.* *Proc. Am. Ry. Eng. Assoc.* 1925, 76-101.—Six additional completed service test records of treated ties are reported. A table is included showing the renewals per mile (1900-1923) for 20 railroads. *Fence post test.*—In 1913 the A. T. & S. F. Ry. started a test at Cleveland, Texas, with several hundred pine fence posts treated with various preservatives. 21 posts were pressure treated with 2% and 4.5% ZnCl_2 absorbing 1.3 and 0.5 lb. per cu. ft. Seventeen were creosoted by the full-cell and 22 by the empty-cell processes with retentions of 3.4 and 5 lb., resp. Additional posts were painted with coal-tar creosote, carbolineum, wood-tar creosote and certain proprietary compds. Others were treated with Na_2SiF_6 and antinonin in an open tank. After 3 yrs. the untreated controls were badly decayed as were most of the painted posts, also those treated with antinonin. The Na_2SiF_6 posts showed decay after 3 yrs. and were badly decayed after 11 yrs. The posts treated by pressure with creosote and ZnCl_2 were in excellent condition after 11 yrs. except 1 ZnCl_2 post which showed decay after 7 yrs. Posts treated with 0.35 to 0.48 lb. FeCl_2 and with 0.89 CuSO_4 per cu. ft. in 1918 had practically failed after 6 yrs.

A. L. K.

Report of Committee XVII. Wood preservation, Appendix C. Treatment with a mixture of creosote and petroleum. R. S. BELCHER, *et al.* *Proc. Am. Ry. Eng. Assoc.* 1925, 102-11.—Creosote for mixts. with petroleum may be any of the standard grades. Creosote-coal-tar solns may be used with certain kinds of petroleum. The petroleum should preferably be of asphalt base but an oil of mixed paraffin and asphalt may be used if when mixed with creosote not more than 1% sediment is formed. The sp. gr. of the petroleum is not important. It must have a min. flash p. in a closed test. of 225°F . The viscosity of the mixt. must be such that it will readily penetrate the wood. Petroleum adds to the life of the timber by retarding checking and splitting. A creosote-petroleum mixt. complying with the above conditions and contg. sufficient creosote to prevent decay is an economical and satisfactory preservative in many regions.

ALFRED L. KAMMERER

Report of Committee XVII. Wood preservation, Appendix F. The effect of preservatives on the inflammability of wood. E. H. BOWSER, *et al.* *Proc. Am. Ry. Eng. Assoc.* 1925, 113-29.—A discussion of the inflammability of creosoted pine particularly as used in bridge and trestle structures. Except with freshly treated material the fire hazard in using creosoted timbers is no greater than if as great as that of untreated wood.

ALFRED L. KAMMERER

Quantity of wood treated and preservatives used in the United States in 1923.

R. K. HELPHENSTINE, JR. *Proc. Am. Wood-Preservers' Assoc.* 1925, 297-321.—A very complete statistical summary, compiled in coöperation with the U. S. Forest Service. ALFRED L. KAMMERER

Wood preservation in Europe. C. M. TAYLOR. *Proc. Am. Wood-Preservers' Assoc.* 1925, 179-189.—A report on observations made while on an European trip. ALFRED L. KAMMERER

A theory on the mechanism of the protection of wood by preservatives. VI. Toxic principles of creosote. ERNEST BATEMAN AND C. HENNINGSEN. *Proc. Am. Wood-Preservers' Assoc.* 1925, 22-8; cf. *C. A.* 14, 1063; 16, 628, 4041; 18, 2064; 19, 2870.—Exptl. data are presented from which the following conclusions are drawn: (1) The essential toxic materials in coal-tar creosote are the hydrocarbon oils b' below 270° and the tar acids and bases b. above 270°. (2) The hydrocarbons distg. below 270° are so much more toxic that they may be considered the essential toxic materials of creosote. (3) The high-boiling tar acids and tar bases may be considered the essential toxic materials for high-boiling distillates such as carbolineum, the potentially toxic hydrocarbons being too insol. to be effective. ALFRED L. KAMMERER

Determining the penetration of metallic salts in treated wood by means of Röntgen rays. F. MOIL. *Z. angew. Chem.* 38, 592(1925) cf. *C. A.* 19, 1185.—Sections of fir and spruce (5 to 20 mm.) untreated and treated with HgCl_2 and NaF were exposed to Röntgen rays over photographic plates. The heart and sap wood as well as the spring and summer wood are distinctly differentiated on the plates. NaF shows no image even in highest concns., whereas HgCl_2 shows a distinct demarcation between the treated and untreated regions. Sections of telegraph poles treated with HgCl_2 and NaF tested in the same manner showed no penetration beyond the limits indicated by the usual $(\text{NH}_4)_2\text{S}$ stain test applied to adjacent sections (cf. *C. A.* 19, 1185), proving that the latter test is entirely satisfactory. ALFRED L. KAMMERER

A one-movement process for impregnating timber with zinc chloride and petroleum. A. M. HOWALD. *Proc. Am. Wood-Preservers' Assoc.* 1925, 81-101.—A process has been developed at the Mellon Institute in coöperation with the Grasselli Chem. Co. for the treatment of timber with an emulsion of ZnCl_2 and petroleum. The water-in-oil emulsion contains 15 to 25% of a 10 to 40% ZnCl_2 soln., the natural asphaltum constituents of a suitable fuel oil acting as a stabilizer. The usual procedures for pressure impregnation are employed. The emulsion is maintained in a state of agitation during treatment by means of a circulating pump. The temp. should not exceed 180° F. The penetration obtained with oak, pine and gum is satisfactory and shows a selective absorption of ZnCl_2 . Operating cost data are presented. ALFRED L. KAMMERER

The comparative resistance of eighteen species of wood-destroying fungi to zinc chloride. C. A. RICHARDS. *Proc. Am. Wood-Preservers' Assoc.* 1925, 18-22.—A series of toxicity tests parallel to the series reported in 1924 (*C. A.* 19, 2871), ZnCl_2 being substituted for NaF. The order of resistance of the fungi to the 2 salts is very different. NaF is slightly more toxic than ZnCl_2 to $2/3$ of the fungi tested. A. L. K.

Methods of prolonging life of mine timber. G. M. HUNT. *Bur. Mines, Bull.* 235, 73-110(1925).—A general discussion of the economics of wood preservation as applied to mine props, including a description of the methods of preliminary handling, peeling, seasoning and preservative treatments with creosote, ZnCl_2 , NaF and CuSO_4 by pressure and non-pressure processes. Specifications for creosote and ZnCl_2 are presented as well as service records of treated timbers in mines, also a consideration of cost on basis of annual charge. A selected bibliography is appended. A. L. K.

When is rot not rot? W. H. LONG. *Proc. Am. Wood-Preservers' Assoc.* 1925, 202-15.—An investigation was initiated to det. whether ties showing incipient decay before treatment are sterilized by the preservative treatment as practiced at a railroad treating plant. The woods studied were Douglas fir, Engleman spruce and cork-bark fir from the mountains of New Mexico, western yellow pine and Texas pine. The ties were treated by the Rueping Process with a 45-55 mixt. of creosote and petroleum at a temp. of approx. 180° F. The timber was affected by the following wood-destroying fungi: *Tremetes pini*, *Polyperus ellisianus*, *P. Schweinitzii*, *Lenzites sepiaria* and *Lenzites lepidus*. The high altitude species were thoroughly sterilized as was the bulk of the Texas pine ties. The sterilization of the western yellow pine was not so successful. ALFRED L. KAMMERER

Temperature and moisture changes in wood under steaming treatment. R. M. WIRKA. *Proc. Am. Wood-Preservers' Assoc.* 1925, 271-289.—A continuation of a former study (cf. *C. A.* 19, 2871). As the work is still unfinished no recommendations are made for steaming practice in timber treatment. ALFRED L. KAMMERER

Nitro-5-chloro-2-hydroxytoluene (for preserving wood) (Brit. pat. 230,968) 10.
Refractory brick (U. S. pat. 1,553,143) 19.

Cement. A. GAERTNER. Brit. 231,007, April 11, 1924. A finely powd. mixt. of fuel and materials which react with the ash to form cement is injected upwardly into the furnace of a Bettington boiler or other vertical cylindrical furnace in which the fuel burns with a mushroom-shaped flame.

Cement. SOC. ANON. DES CEMENTS FRANCAIS AND BUREAU D'ORGANISATION ECONOMIQUE. Brit. 232,155, April 9, 1924. Cement-forming materials are fed to a rotary kiln, pass first through a zone at a temp. of about 1000°, then to a zone at 1600–1700° and are discharged in a molten state above 1500°.

Portland cement. H. KÖHL. Brit. 231,535, March 31, 1924. A cement having high initial strength without excessive speed of setting comprises, preferably, SiO₂ 14–18, Al₂O₃ 6–10, Fe₂O₃ 5–10, and CaO 60–65%. Generator slag, blast furnace slag, siliceous bauxites, pyrites cinders and siliceous Fe ores may be used as raw materials.

Cement containing titanium. E. C. ECKEL. U. S. 1,555,405, Sept. 29. An artificial Ti compd. such as a slag contg. Ti is added to a cement mixt., during or before fusion or clinkering, to produce a quick-hardening cement resistant to chem. action and of high sp. gr.

Aluminous cement. S. SEAILLES and J. SEAILLES. U. S. 1,556,038, Oct. 6. After placing in position a layer of aluminous cement, a layer of ordinary cement is immediately placed over it.

Aluminous cement construction. SOC. LAP. Brit. 231,867, April 1, 1924. A layer of aluminous cement or concrete, after being formed but before it sets, is faced or backed with another layer of ordinary hydraulic cement and the 2 layers are allowed to set together simultaneously.

Compositions of cements and synthetic resins. V. LEFEBURE. Brit. 231,242, Dec. 29, 1923. Port. cement or other cements or plaster compns. are mixed with condensation products such as those of phenol-, urea-, or thiourea-formaldehyde and the mixt. is molded and heated to effect conversion of the condensation product into final form after setting of the cement. The condensation product may be preliminarily adsorbed by or mixed with a filler such as kieselguhr or colloidal clay.

Cement clinker. C. B. HILLHOUSE. U. S. 1,555,283, Sept. 29. Lime is added to Fe sponge in less quantity than that required for clinker, the materials are fused in a fusion furnace at a temp. substantially lower than that for clinkering, liquid slag is withdrawn from the furnace, heated to clinkering temp. and admixed with a further quantity of lime to form cement clinker.

Rotary cement kiln. J. W. FULLER. Brit. 231,139, March 19, 1924.

Charging rotary cement kilns, etc. A. ANKER. Brit. 231,875, April 2, 1924. In feeding a cement-forming mixt. or the like to a rotary kiln, the material is passed by an extrusion press through a heated tube whence it goes into the kiln in broken pieces of approx. even size free from dust and small fragments.

Impregnating concrete. F. S. HONBERGER. U. S. 1,555,208, Sept. 29. Air and moisture are exhausted from concrete by the action of a vacuum, the concrete is heated and is submerged in a hot impregnating liquid such as asphalt while still *in vacuo*. The material is then cooled and subjected to pressure to facilitate impregnation.

Composition for waterproofing concrete. F. GUY. U. S. 1,550,355, Aug. 18. A soapy soln. is mixed with sand, allowed to set, pulverized and mixed with alum.

Impregnating concrete. F. S. HONBERGER. U. S. 1,555,209, Sept. 29. Concrete piles or other articles of concrete or similar porous material are submerged in heated asphalt or other impregnating material and allowed to become heated and subsequently to cool in the liquid, meanwhile circulating the liquid and removing foam which is formed.

Light-weight aggregate for use in concrete. G. A. WALKLEY. U. S. 1,556,268, Oct. 6. A plastic mixt. is formed of clay and finely divided coal or other fuel, molded masses are formed from this mixt. and they are dried and fired in a kiln.

"Artificial marble." H. J. KIMMEL and L. A. HARRIS. U. S. 1,550,077, Aug. 18. A mortar of pasty consistency and which may be formed of MgO, marble dust or sand, port. cement, asbestos, MgCl₂, MgSO₄ and CaCl₂ is allowed to dry in forms at a temp. of about 27° for about 24 hrs., and then, after removal of the forms, is maintained at about 35° for a period of about 24 hrs. The temp. is then increased to about 52° during a period of about 36 hrs.

Building material. A. C. FISCHER. U. S. 1,550,310, Aug. 18. Sheets of tar paper,

felt or similar material are satd. with a slow-drying adhesive substance such as gilsonite and vegetable oils which forms an adhesive surface.

Building blocks, roofing tiles, etc. H. GRONROOS. U. S. 1,552,431, Sept. 8. Molded articles for building purposes are formed by mixing slags 400, glass refuse 100, clay 100, Fe oxide 1, KNO_3 5 and quartz 2 parts, adding H_2O , molding under a pressure of 50–200 kg. per sq. cm., and burning first at about 300° for about a half hr. and then at about 740° for a half hr.

Waterproof building material. F. T. WALKER. Brit. 231,653, March 13, 1924. Ground oolitic limestone is mixed with pitch and tar, with or without bitumen or a small addn. of cement. The mixt. may be molded into blocks or applied directly in building construction.

Bituminous compositions. R. C. VAN HAAGEN. Brit. 231,503, March 27, 1924. A compn. for covering roads, roofs, floors, etc., comprises a soln. of vulcanized rubber in asphalt mixed with a mineral filler such as sand, pulverized basalt or slag.

Coating composition. N. E. NEWMAN. Brit. 217,542, June 14, 1923. A coating compn. adapted for use on roofs, basement walls, etc., comprises long fiber blue or yellow asbestos (known as amosite and mined in Griqualand, South Africa) and a binder, preferably of elastic material such as Trinidad or Bermuda asphalt or gilsonite. Drying oils also may be added.

Composition shingles. W. H. GRAVEMAN. U. S. 1,549,867, Aug. 18. Shingles, etc., are formed by heating a mixt. of pulverized coal taf pitch and pulverized slag or similar material to about 100° , pressing the heated mixt. into the desired shape and then heating to a carbonizing temp.

Dyed waterproof floor-covering felt impregnated with wax tailings. L. KIRSCHBRAUN. U. S. 1,549,991, Aug. 18.

Apparatus for forming felted waterproofed sheets. L. KIRSCHBRAUN. U. S. 1,549,992, Aug. 18.

Heat-insulating building board composition. D. C. LOHMANN. U. S. 1,554,358, Sept. 22. Paper pulp 50–60, clay 25–75 and wheat flour 2–12 lbs.

Preserving wood. A. C. HOLZAPFEL. Brit. 231,029, May 6, 1924. Hot wood is treated with a soln. of oleate of Hg, Zn or Cu or a similar compd. in gasoline, with or without the addn. of rubber or coumarone resin.

21 FUELS, GAS, TAR AND COKE

A. C. FIELDNER

The evaluation of coal. KARL STOCKFISCH. *Z. angew. Chem.* **38**, 611 (1925), cf. C. A. **19**, 1485.—The amt. of air needed for combustion is about 1.5 times that calcd. from an elementary analysis. The net heating value can only be approximated from analysis. C. G. KING

Froth flotation of Indian coals. W. R. NDALL. *Records Geol. Survey India* **56**, part 3, 220–249 (1925).—The advisability of using the froth flotation process for cleaning Indian coals is discussed. The advantages and disadvantages are brought out and the equipment needed is described. The results of flotation tests on 35 coals are given. Ten analyses of typical coals are recorded. A bibliography is included. J. F. S.

The drying of brown coal through gases. HILLIGER. *Die Wärme* **48**, 273 (1925).—The use of air and furnace gas for the drying of brown coal is dealt with and their efficiency is demonstrated by means of diagrams. OSCAR PAUK

Manufacture of some by-products of coal distillation. A. BARIL. *Extrait compte rend. 41ème congrès soc. tech. ind. gaz. France* **1924**, 1–41. A detailed description of the processes used at the Gennevilliers plant of the Société d'Éclairage, Chauffage et Force Motrice (Paris) for the extn. of crude phenols from coal tar and for the manu. of H_2SO_4 , and of the control of $(\text{NH}_4)_2\text{SO}_4$ manu. A. PAPINEAU-COUTURE

The distillation of coal and tar with the use of a metal bath. A. THAU. *Glückauf* **61**, 821–31 (1925). OSCAR PAUK

Coal and coke. R. W. MORRIS. *Mineral Ind.* **33**, 129–63 (1924).—Production, stocks, consumption, imports and exports, and the industry in foreign countries are covered. A. B.

The combination of water in deep swamp mold. GUSTAV KEPPELER AND FRIEDRICH KRANZ. *Kolloid-Z.*, Special No., Apr. 1, 1925, p. 318–29.—Water in peat can be free (drains out), pressed out (capillary according to Ostwald), adsorbed H_2O (colloid H_2O according to Ostwald), and chemically bound H_2O . Since the drying of peat

the most important problem in its prepn., the amt. of H_2O in each condition is an important consideration. A vapor pressure-concn. diagram seems the best way to study the condition of the H_2O in peat. An old sphagnum peat was prepd. in as pure a form as possible, frozen, drained, pressed, air-dried, heated at 100° and heated at 230° . Unchanged peat contains 85% H_2O after draining, 75–80% after pressing, 18% after air drying and takes up 43% when rewet. Frozen peat contains 84% H_2O after draining, 70% after pressing, 15% after air drying and takes up 40% when rewet. Peat heated to 100° contains 83% H_2O after draining, 70% after pressing, 8% after air drying and takes up 33% when rewet. Peat heated to 230° contains 61% H_2O after draining, 50% after pressing, 2.5% after air drying and takes up 10% when rewet. When vapor pressure is plotted against % of H_2O there are sharp breaks in the curves which appear at the points indicated by the data above. F. E. BROWN

Vacuum distillation and steam distillation in the production of benzene. H. BÄHR AND G. RÜHL. *Glückauf* 61, 574–80 (1925).—The advantages of the distillation of benzene in vacuum against steam distillation are as follows: The lower consumption of steam, the possibility of a just as complete sepn. of the washing oil and the better saving of the latter. OSCAR PAUK

Second report of the marine oil-engine trials committee. G. G. GOODWIN, *et al.* *Proc. Inst. Mech. Eng* 1925, 439–532; discussion 542–605.—An extremely detailed account of stationary tests ashore and of steady speed and maneuvering tests afloat. The engines were 2-cycle with mech. fuel injection and an extensive heat recovery system. The ship in which the sea tests were performed was of 11,533 tons displacement. WM. B. PLUMMER

- **Gaseous combustion at high pressures. V. The explosion of hydrogen-air and carbon monoxide-air mixtures at varying initial pressures up to 175 atmospheres.** WM. A. BONE, D. M. NEWITT, AND D. T. A. TOWNSEND. *Proc. Roy. Soc. (London)* 108A, 393–418 (1925), cf. C. A. 18, 2069.—By the use of a Cr-Ni steel bomb with spherical explosion capacity of 239 cc., and tested to withstand 2000 atm. pressure, gaseous explosion tests were made with H-air and CO-air mixt., with initial pressures ranging up to 175 atm. H, O, N, CO and A were used as diluent gases. The time for reaching max. pressure was within 0.005 sec. and decreased with increasing P_i , except for the CO-air mixt., in which case it increased 8 times from $P_i = 3$ atm. to $P_i = 175$ atm. The difference is attributed to N_2 activation (I). Secondary formation of NO was negligible except when an excess of air was present. In that case NO_2 was formed (2–2.4%) in excess of the theoretical amt., which was also attributed to (I). There was no evidence of "after burning" when P_i exceeded 10 atm. The amt. of steam dissociated never exceeded 1%. Dissociation of CO_2 (15–25%) could be almost entirely suppressed by using an excess of CO, even at 3000° . The corrected P_m/P_i ratio increased in every case with increasing P_i , 14.3–31.8% for a P_i range of 3–150 atm. C. G. KING

(Producer) gas cooling with recovery of heat. JULIUS FABIAN. *Z. angew. Chem.* 38, 185–7 (1925).—Producer gas from coke is usually hot enough to use under waste-heat boilers. Brown-coal gas is not only much cooler, but heavily loaded with H_2O vapor. F. proposes to cool brown-coal producer gas by H_2O sprays. The gas passed up through a packed tower down which cold H_2O is sprayed. The heated H_2O goes to a 2nd packed tower up through which the blast for the producer is passed. The H_2O from here goes to a spray-pond to be further cooled before returning to the first tower. This cools the gas, lowers its H_2O content (thereby increasing its flame temp.) and not only returns the heat to the producer but furnishes enough H_2O vapor in the hot moist blast to replace all the steam previously supplied from boilers. Applied to a producer gasifying 220 tons per day of raw brown coal of 55% H_2O , the air blast was heated to 52° and satd. at that temp., replacing 22 tons per day of boiler steam. On a producer gasifying 100 tons per day of brown coal briquets of 15% H_2O , 88% of the steam needed (26.5 tons) was returned. W. L. BADGER

The importance of the production of tar and its derivatives in the national economy of Italy. LUIGI DAL PRATO. *Rass. min. met. chim.* 63, 42–5 (1925); cf. C. A. 19, 3156. Methods for converting tar into other com. products by various processes are described, including its distn. at ordinary pressure in the presence of porous catalytic substances with and without a gas current and the catalytic depolymerization of heavy oil with and without the aid of reducing gases under pressure. C. C. DAVIS

Stream pollution by wastes from by-product coke ovens. R. D. LEITCH. U. S. *Pub. Health Repts.* 40, 2021–6 (1925).—A review and discussion, mentioning particularly the bacterial filter, benzene washing, and coke quenching as the most important methods for removal or destruction of phenol in plant effluents. Although the latter process produces corrosive gases and increases plant maintenance costs, it seems to be the best

available, at least for plants producing metallurgical coke in which the presence of odor is not deleterious. A bibliography of 87 references is given. WM. B. PLUMMER

Low-temperature distillation and the central station. G. A. ORROK. *Elec. World* 86, 620-2 (1925).—Because of the mech. and thermal difficulties in low-temp. coking, its application by central stations would be of doubtful value. They use but 6% of the bituminous coal consumed. It is claimed that it is not economical to save by-products when coal costs more than \$1.50 per ton (909 kg.) and the by-products bring less than \$1.62 per ton. W. H. BOYNTON

Gas washing (WEISSENBERG) (WEISSENBERG, SCHUSTER) 13. Combustion control of open hearths (CONWAY) 9. Experiments with explosive gas mixtures (OHMANN) 2. Explosion experiments with vaporized liquids (OHMANN) 2. Petroleum and natural gas (DAY) 22. Coal washing in 1924 (RICHARDS, LOCKE) 9. Distilling lignite (Brit. pat. 231,453) 22. Retort for distillation of coal (U. S. pat. 1,552,471) 1. Distilling tars (Brit. pat. 231,686) 13. Emulsions for binding fuels (U. S. pat. 1,556,005) 22.

Fuel for internal-combustion engines. H. TERRISSE. U. S. 1,556,047, Oct. 6. Kerosene or other hydrocarbon material heavier than ordinary gasoline is mixed with EtOH and AcH. Cf. *C. A.* 19, 166

Lignite fuel. E. P. SCHUCH. U. S. 1,556,036, Oct. 6. Lumps of raw dehydrated lignite are impregnated with oil.

Carbonaceous material for fuel, absorption or catalysis. F. GOUTAL and H. HENNEBUTTE. Brit. 231,863, April 1, 1924. Wood, peat or lignite is charred at a temp. below 500° and mixed with a binder such as oxidized substances from the heat treatment of tar from wood, peat or lignite, which are decomposable at temps. below 500°, with or without a small quantity of oxides or salts of Cu, Ni, Zn or Fe. The mixt. is pulverized, compressed and heated at 300–500° until evolution of H₂O vapor ceases.

Liquid motor fuel. H. B. HUTCHINSON and DISTILLERS CO., LTD. Brit. 232,276, Oct. 17, 1923. A stable mixt. of alc. and gasoline is obtained by distg. the mixt. until the greater portion of the contained H₂O has passed over, allowing the distillate to stand, and mixing the layer consisting mainly of alc. and hydrocarbon with the mixt. of alc. and hydrocarbon remaining in the still.

Non-freezing motor-cooling composition. J. R. CLAWSON. U. S. 1,550,009, Aug. 18. A mixt. of potato flour or similar starchy material, tannin, CaCl₂ and H₂O.

Briquetting fuel. L. LIAIS. Brit. 231,140, March 18, 1924. Asphaltic material m. 90–120° is melted and treated with 2½–5% of NaHCO₃ or other substance capable of forming gas within the mass to convert it into a foam, which is rapidly cooled, e. g., by running into cold H₂O. The resulting porous mass is crushed and mixed with coal dust for briquetting.

Fuel briquets. W. PRESCOTT and D. F. WORGER. U. S. 1,554,462, Sept. 22. Small coal 90% or more is mixed with less than 0.25% of lime, 1% of glue and 6% of H₂O and there is added to the mixt. a 40% CH₂O soln. in the proportion of not more than 0.20%, immediately before pressing and molding.

Charcoal fuel briquets. W. A. LEUBENBERGER and W. T. DUMBLETON. U. S. 1,550,034, Aug. 18. Briquets molded from previously prepd. charcoal are heated to 115–315° according to the characteristics of the product desired.

Apparatus for preparing fuel from peat. E. P. R. ULMANN. U. S. 1,554,472, Sept. 22.

Apparatus with steam-jacketted tubular retorts for distillation of carbonaceous fuels, shale, etc. F. LAMPLOUGH. U. S. 1,554,587, Sept. 22.

Treating coal. J. F. LAHART. U. S. 1,555,590, Sept. 29. Coal is treated with about 1–2% of a mixt. of salt, lime and cement, to regulate its combustion and lessen the smoke production.

Carbonizing coal. W. RUNGE. Brit. 231,159, March 21, 1924. Pulverized coal or other carbonaceous material is carbonized by showering it through a rising stream of hot combustible gases, the volatile products being withdrawn together with the hot gases at the upper part of the carbonizing zone, which is maintained at a temp. not exceeding about 815°. An app. is described.

Carbonization of coal or other fuels. H. E. SMITH. Brit. 231,298, Feb. 28, 1924. Finely divided fuel is charged into spherical containers which are heated by passage through a heated chamber in a gas producer or gas producer plant.

Distillation of coal, peat, etc. F. M. PERKIN and BETTISFIELD TRUST CO., LTD. Brit. 232,358, Jan. 31, 1924. Coal, peat or other material to be distd. or carbonized in externally heated retorts in which inert gas or steam is passed through the charge is

preheated to about 250° before introduction into the retort. This avoids clogging of the retort in the case of bituminous coal. An app. is described.

Drying and distilling peat. H. NIELSEN. Brit. 231,592, Jan. 5, 1924. Pulped or macerated peat is heated, subjected to the action of a vacuum filter, treated with superheated steam under pressure and then subjected to a sudden release of pressure in an expansion chamber. It may then be briquetted, further dried and distilled to produce coke, oils, NH_3 and gas.

Rotary drum apparatus for distilling coal, etc. KOHLENSCHIEDUNGS-Ges. Brit. 232,456, July 11, 1924.

Apparatus for producing combustible gas from water and crude oil or other liquid hydrocarbons. E. M. C. McALPINE. U. S. 1,550,273, Aug. 18.

Water gas. HUMPHREYS AND GLASGOW, LTD. Brit. 231,866, April 3, 1924. During the blow, air passes downwards through a superheater, up a carburetor and thence to a producer where it flows upwards and downwards to 2 different valves. Other features of control of flow of gases and steam are described. Cf. C. A. 18, 2422.

Down-run apparatus for water-gas manufacture. P. DVORKOVITZ. U. S. 1,554,073, Sept. 15.

Gas producer. RHEINISCHE METALLWAAREN- UND MASCHINEN-FABRIK and F. PACHER. Brit. 232,496, Sept. 19, 1924. An auxiliary air blast app. is provided which supplies air on reduction in pressure due to failure of the main air supply.

Gas purifying apparatus. H. LUMB, J. E. HORSFALL and R. DEMPSTER & SONS, LTD. Brit. 232,012, March 17, 1924.

Gas retort furnace construction. H. J. TOOGOOD and R. DEMPSTER & SONS, LTD. Brit. 232,357, Jan. 31, 1924.

Coking fuel briquets. T. A. GOSKAR. Brit. 231,934, Jan. 9, 1924. Fuel briquets for coking comprise a mixt. contg. 70–90% of a non-caking coal and 30–10% of a binder formed by grinding caking coal to a powder of 150–200 mesh and adding H_2O tar, etc., to form a smooth paste. The coking of the briquets may be effected with hot producer gas.

Coking pitch or other bituminous materials. F. W. SPERR, JR. U. S. 1,553,641, Sept. 15. Pitch or similar material is treated with hot kerosene or other solvent to extract the more readily fusible constituents and the residue is then coked.

Coke oven. P. ALIDJIADIS. U. S. 1,553,795, Sept. 15.

Coke-oven construction. J. BECKER. Brit. 232,173, April 10, 1924.

Coke oven with vertical heating flues. SOC. GENERALE DE FOURS A COKE SYSTEME LECOQ. Brit. 231,483, March 29, 1924.

Coking-retort oven. J. BECKER. U. S. 1,553,662, Sept. 15.

22- PETROLEUM, LUBRICANTS, ASPHALT AND WOOD PRODUCTS

F. M. ROGERS

Chemical transformations of petroleum. HENRY GAULT. *Bull. soc. ind. Mulhouse* 91, 439–66(1925).—An address on cracking, hydrogenation, chlorination and oxidation of petroleum.

Petroleum and natural gas. D. T. DAY. *Mineral Ind.* 33, 515–58(1924).—A review of the industry, covering U. S. and world production, supplies and petroleum shale.

The bituminous schists of Castoreale and Barcellona (Sicily). M. BAKUNIN and F. GIORDANI. *Ann. chim. applicata* 15, 265–72(1925).—The zones of schist occur in Eocene clay superposed on cryst. rock and are composed chiefly of very thin strata, though a certain proportion occurs in strata several cm. thick. The following data give percentages for a thick sample of schist and the limiting percentages of 10 other samples of thin schists: H_2O 1.33, 2.06–5.77; volatile 10.63, 11.23–22.80; fixed C 6.51, 5.95–11.67; ash 81.53, 61.83–77.19; total S 2.14, av. 2.20; total N 1.60, av. 1.78. The data indicate that the schists are not inferior to Scotch schists (cf. Alderson, C. A. 14, 3526). The best results were obtained by distg. at 500–50° in a closed retort, under which conditions the thick and thin schists gave the following results: pyrobitumen (fixed C + volatile) 17.14, 17.18–33.11; oil distd. 8.8, 5.6–11.0; aq. NH_3 4.0, 6.0–9.0; oil from the pyrobitumen 52, 28–33; fixed C in the coke —, 7.0–11.0. The % oil from the bitumen indicates that the thick and thin schists differ in character. The thick schist and a typical thin one yielded 28.66 and 37.20 m.³ of gas (0° at 760 mm.) per

ton, which contained unsatd. hydrocarbons, CO_2 , O, CO, CH_4 , H and N and had calorific powers of 5650 and 6394, resp. The distd. oil combined from all the schists had d. 0.960, calorific power 10,783 and S 2.62% (cf. Giordani, *C. A.* 19, 2740), which indicates a good quality because of the low S content. The schists are in general promising because of the good yields of oil and N and their low S content. C. C. DAVIS

A new furnace for the distillation of bituminous schists. F. GIORDANI. *Ann. chim. applicata* 15, 273-82(1925).—A description, with diagrams and photographs, of a new type of furnace which differs from the Messel and Scotch types (cf. Scheithauer, *Die Schwelteere*, 2nd Ed. Leipzig 1922) in that a thermal balance is established in the furnace based on the fact that kerogen decomps. in 2 stages (cf. MacKee and Lyder, *C. A.* 15, 3904; De Bartolomeis, *L'industria del gas e degli acquedotti* 8, 158(1919)) and that the heat of decompn. is very small (cf. Masse, *Le Gaz*, ii, 754, Paris 1914; MacKee and Lyder, *C. A.* 15, 3905; Jones, *C. A.* 16, 1500). The general principles of the Scotch process were followed, except that external heat was replaced by internal heating with gas from combustion of the coke. In this way there was the enormous advantage of eliminating cond. through the walls and through a material of very low thermal cond. The best results were obtained at 500-50° higher temps. being attained at the expense of the oil. The vertical furnace comprises 3 zones, increasing in size from top to bottom. The schist is charged at the top and is preheated in the upper zone, from which lead tubes for withdrawing gas and vapors. The main distn. occurs in this upper zone and the coke descends at 500-50° to the next zone and meets an ascending air current. In this zone combustion of the fixed C occurs at 700-50°. The air which enters through tuyères in the lower zone recovers the heat of the descending residue. This lower zone is immersed in a H_2O -seal, and the H_2O , which requires a temp. of 70-80°, vaporized, is entrained by the air current and is carried through the combustion zone, the yield of NH_3 (cf. Franks, *C. A.* 15, 939) and the heat efficiency being thus increased. A condenser, gas extractor and scrubber, centrifugal fan, etc., complete the equipment. The yield of oil is 80-85% that in a closed retort on a lab. scale. Four furnaces each 7 m. high and with zones increasing from 0.5×0.5 to 0.8×0.8 m. distg. a total of 10 tons per day are in successful operation. C. C. DAVIS

Italian standard methods for mineral oils, colors and boiled oil. *Z. deut. Öl-Fett-Ind.* 45, 477-8, 494-5(1925).—Standard methods proposed by the Italian Commission under the following captions: Benzine and fuel oils. I. A. Phys. detns. B. Chem. detns. II. Benzine and petroleum. III. Fuel oils. Lubricating oils. 1. Cylinder oils. 2. Motor and steam-turbine oils. 3. Steamer oils. 4. Compressor oils. 5. Axle greases. 6. Machine oils. 7. Refrigerator oils. P. ESCHER

Detection and elimination of odors from oil refineries. R. S. WESTON. *Proc. Am. Soc. Civil Eng.* 51, 1193-7(1925); cf. *C. A.* 19, 2124.—A discussion. J. M. H.

Transformer oils and methods of testing them. I. MUSATTI AND A. PICCHETTO. *Ann. chim. applicata* 15, 238-65(1925).—A detailed and crit. discussion of the so-called German, French, Italian, English, Brown-Boveri and Snyder methods and the tentative Am. Soc. Testing Materials procedure for detg. the tendency of transformer oils to form a sludge. All these methods have shortcomings and none duplicates the conditions under which sludge is formed in actual use. Expts. were carried out with a view to detg. the relation between the phys. and chem. properties of oils from different sources and their tendency to oxidize. The oxidation expts. were based on a method which differed in detail from any of those above, but which most closely resembled the Brown-Boveri method. Cylindrical Cu cups, 50.3 mm. diam. and 63 mm. high and marked at a depth of 50.3 mm., allowed the reception of 100 cc. of oil. These were heated with free access of air both in a const. temp. air oven and in an oil bath at different temps. for long periods. After oxidation the oil was let stand, dild. with 2 vols. of benzine or preferably petr. ether, and centrifuged or let stand, filtered, washed on a tared filter and dried at 105°. An aliquot part of the filtrate was tested for acidity (by extn. with EtOH) after evapn. of the solvent *in vacuo*. The sludge, though insol. in benzine and petr. ether, was sol. in CHCl_3 , CCl_4 , C_6H_6 and partially in AmOH and EtOH + Et $_2\text{O}$, contained asphaltenes and was similar in all respects to the sludge formed under normal conditions in the same oil. Furthermore the sludge was identical in part with substances originally present in mineral oils and which, therefore, have originated in an analogous manner. The results indicate that there is no relation between the I no., Br no. or formolite no. of the original oil and its tendency to oxidize under the conditions of the expts. On the other hand the greater the proportion of an oil extractable with liquid SO_2 , i. e., the greater the amt. of non-satd. or aromatic hydrocarbons, the greater is the quantity of sludge obtained. Even at relatively low temps. such as 93° the amt. of sludge formed on exposure to air for such periods as 800 hrs. may be considerable and at higher temps. the amt. increases

rapidly, an approx. parallelism existing between the temp. and the proportion of sludge formed (cf. Snyder, *Proc. Am. Soc. Testing Materials* 24, ii, 955(1924)). A bibliography of 66 references is included. C. C. DAVIS

The breakdown mechanism of moist insulating oil. A. GYEMANT. *Naturwissenschaften* 13, 726-7(1925).—Small water drops, emulsified in oil, tend to assume an ellipsoid form when brought in a strong elec. field with $\alpha = f(rE_0/\gamma)$; α is ratio between major axis and diam. ($2r$) of original sphere, E_0 is field intensity, γ water-oil surface tension. When the field is sufficiently strong these ellipsoids arrange themselves to form water channels through the oil, causing short circuits. This theory agrees with exptl. data of Friese (*C. A.* 16, 2943); decreasing moisture content first causes a very slow, later on (for less than 0.1%) a rapid rise of the breakdown potential. Oil with 0.1% water, size of drops 2×10^{-3} cm., gives a calcd. value of 27 kv./cm., compared with the exptl. value 22 kv./cm. B. J. C. VAN DER HOEVEN

Asphalt. PRÉVOST HUBBARD. *Mineral Ind.* 33, 81-7(1924).—Discusses production, uses, tests and specifications, related hydrocarbons, etc. A. B.

Gas washing (WEISSENBERGER) (WEISSENBERGER, SCHUSTER) 13. Possible inorganic petroleum (LEWIS) 8. Poisoning by $PbEt_4$ (NORRIS, GETTLER) 11H. Apparatus for distillation of shale (U. S. pat. 1,554,587) 21. Filter for gasoline (Brit. pat. 230,991) 1. Distilling mineral oils (Brit. pat. 231,686) 13. Apparatus for separating water and impurities from hydrocarbons (U. S. pat. 1,555,231) 4.

Cracking hydrocarbon oils. E. C. HERTHEL and H. L. PELZER. Brit. 232,178, April 8, 1924. Pitchy substances are removed from oil undergoing cracking by passing the oil through a bed of fuller's earth or other absorbent clay, silica gel or equiv. material supported in the still. A portion of the pitch-laden oil is also withdrawn and replaced by fresh oil.

Cracking hydrocarbon oils. M. MELAMID. Brit. 231,190, March 22, 1924. Cracking of crude oil, tars or tar oils is carried out at temps. of 300-400° (by atomizing with H or gases contg. H in the presence of a catalyst which is liquid at the reaction temp.) so that only the lower-boiling constituents of the material treated are decomposed. Cf. *C. A.* 19, 892

Cracking hydrocarbon oils. E. W. ISOM. U. S. 1,553,168, Sept. 8. The oil is mech. circulated from and to a bulk supply tank through a heater, heated to a cracking temp. in the heater, and fresh oil is introduced into the circulating oil during the progress of distn. and is employed for cooling the circulating pump before introducing it into the distg. app.

Cracking hydrocarbon oils. GASOLINE PRODUCTS CO., INC. Brit. 232,283, Dec. 10, 1923. In gasoline production by cracking fuel oil, crude or topped oils, etc., a portion of the oil is cracked by passing it under pressure through a heated coil and into a reaction chamber. The cracked oil is blended on discharge from the reaction chamber into a vaporizing chamber with an oil which has been heated to a temp. sufficient to produce substantial distn. An app. is described.

Gasoline production by cracking of heavier hydrocarbons. A. D. SMITH. U. S. 1,550,115, Aug. 18. Residual liquid after cracking is filtered to remove the larger particles of free C, centrifuged to remove a portion of the colloidal C, and the purified liquid is then returned to the cracking zone. An app. is described.

Converting hydrocarbon oils. W. E. SHORE. Brit. 231,625, Feb. 13, 1924. A heavy oil to be converted into lighter products is atomized with H and the mixt. is subjected to compression considerably to raise its temp.

Still with internal electric resistance heater for cracking or converting hydrocarbon oils. O. P. AMEND. U. S. 1,553,300, Sept. 15.

Distilling hydrocarbon oils. W. B. LINDSAY and W. B. DAVIDSON. Brit. 232,347, Jan. 23, 1924. Crude or topped oil is distd. by spraying it into combustion gases such as those from a gas producer in which coke is burned with regulated air supply to avoid O and CO in the gas) mixed with cooler gases such as residual gases from the process or low pressure steam. Finely divided Fe may be blown into the vapors in, one of the condensers to effect a purification. An app. is described.

Pressure distillation and conversion of hydrocarbon oils. R. E. HUMPHREYS, F. M. ROGERS and M. G. PAULUS. U. S. 1,553,861, Sept. 15. In distg. "fuel oil" or similar oils to obtain hydrocarbons of lower b. p., the material is treated in a closed vessel in the vapor space of which about 4% or more of the vapors of the desired product are maintained (these having a b. p. of 120-205°) by exerting pressure on the vessel. Portions of the liquid petroleum material are converted into naphtha fractions b. at

120° or lower at the rate of 1.2% per hr. up to 17.7% per hr. (calcd. on the vol. of the charge) by maintaining the material at conversion temps. of about 400–430°. Gas from the conversion is removed from the still and passed through a condenser to recover hydrocarbons of low b. p.

Purifying hydrocarbons. AKT.-GES. FÜR CHEMIEWERTE. Brit. 231,900, April 5, 1924. Mineral oils and aromatic hydrocarbons such as C_6H_6 and xylene, after purification by acid, are neutralized without formation of emulsions by using lyes absorbed in solid carriers such as fuller's earth and kieselguhr. The oil is washed with H_2O after sepn.

Refining liquid hydrocarbons. A. E. DUNSTAN. U. S. 1,552,830, Sept. 8. Benzene, kerosene, shale oil or similar liquid hydrocarbon material is treated with an alk. hypochlorite soln. and then with caustic alkali soln. Another batch of hydrocarbon material, before treatment with the hypochlorite, is washed with the residual caustic alkali soln.

Purifying liquid hydrocarbon oils. F. B. THOLE and S. T. CARD. Brit. 231,944, Jan. 11, 1924. In desulfurizing liquid hydrocarbons with alk. solns. of hypochlorites, the free alkali content is reduced during or immediately prior to the treatment, preferably by passing CO_2 into an agitated mixt. of the oil and alk. hypochlorite to react with all the NaOH present. $FeCl_3$ and the sulfates of Fe, Zn, Mn and Mg also may be used to react with the free alkali.

Apparatus for dephlegmation and rectification of hydrocarbon vapors. D. PYZEL. Brit. 231,334, April 22, 1924.

Oil from shale. G. A. BRONDER. U. S. 1,552,539, Sept. 8. Shale is heated to effect distn. while carried by a conveyer.

Filtering material from shale residue. D. T. DAV. U. S. 1,555,639, Sept. 29. Porous spent shale material of a siliceous nature such as that left as a residue after oil distn. from shale is heated with a strong NaOH soln., forming Na silicate in its pores, then treated with H_2SO_4 to form free silicic acid in the pores, washed with H_2O to remove Na_2SO_4 and heated to low redness. U. S. 1,555,640 specifies heating a mixt. of shale and alkali and grinding the product.

Rotating retorts arranged in series, adapted for distilling oil from shale. F. S. BACON. U. S. 1,556,194, Oct. 6.

Converting oils. BENZONAFTENE. Brit. 231,157, March 24, 1924. Heavy oils such as fuel oils and fatty substances of animal, vegetable or mineral nature are treated to yield "liquids analogous to petroleum or naphtha" and a gas suitable for lighting or heating purposes. The materials are heated to 450–600° with Ce oxide and reduced Cu and are then subjected to the action of Th oxide and reduced Ni at the same temp. Hydrocarbon vapors are sep'd in a condenser which is maintained at a temp. of about 30° and the remaining vapors are subjected to the action of Fe oxide and reduced Ni at 200° and are cooled to 15° to sep. additional hydrocarbon liquid. The still uncondensed vapors are treated with Fe oxide and reduced Fe at 250–300° and cooled to 10° to sep. more liquid. Brit. 231,459 specifies an app. for carrying out this process. Brit. 231,460 specifies withdrawal of the gases produced from processes of this character, compressing them to 20 atm, and passing them through a liquid separator and cooler to effect liquefaction. The liquid thus obtained is subjected to fractionation to obtain rhigolene, petr. ether, gasoline and ligroine. The uncondensed gases pass through a washer contg. H_2SO_4 heated to 150°, or Br, to absorb C_2H_4 and thence to a scrubber and holder. They may be used to heat the still.

Cracked hydrocarbon products. BENZONAFTENE. Brit. 231,461, March 28, 1924. Liquid hydrocarbons prep'd. as described in Brit. 231,157 and 231,459 (cf. above) are distd. in a furnace-heated still and different fractions of the distillate are treated with conc'd H_2SO_4 and NaOH and air, further distd. and the vapors are passed through purifiers contg. Ca and Mg oxides and filters contg. animal black. Part of the still residues is mixed with vegetable pitch, oil and rubber and used for manuf. of elec. insulation and part may be burned to produce lamplack. Another portion is mixed with heavy oil, MnO_2 and colophony to produce a siccative oil similar in properties to linseed oil.

Dephlegmating dome for oil-converting apparatus. J. H. ADAMS. U. S. 1,549,894, Aug. 18.

Heating tubular stills for cracking oils, etc. J. E. BELL. Brit. 231,840, April 1, 1924. Furnace gases used for heating oil tubes are mixed with preheated gas or air of somewhat lower temp. before being brought into contact with the oil tubes.

Asphalt fluxing oil. W. M. BURTON. U. S. 1,553,847, Sept. 15. Fuel oil or a similar petroleum oil is distd. under pressure until a substantial proportion of its con-

stituent hydrocarbons has been converted into hydrocarbons of lower b. p. and distn. off. The tarry residue is then subjected to distn. in the presence of open steam until its Engler viscosity at 100° is approx. 6.

Oil refining. J. MCK. BALLOU. U. S. 1,553,973, Sept. 15. Heated crude petroleum oil is injected into a sepg. compartment and maintained under pressure by a special arrangement of the app., to prevent foaming.

Aluminium chloride. F. W. HALL. U. S. 1,549,766, Aug. 18. Acid sludge from oil refining is heated to render it liquid, mixed with powd. Al ore such as bauxite so that the latter is in suspension, and the mixt. is coked and chlorinated to produce $AlCl_3$.

Breaking petroleum emulsions. W. S. BARNICKEL. U. S. 1,555,818, Oct. 6. Petroleum emulsions such as those contg. brines are broken by the use of Cl, Br or nitro derivs. of resin or other deriv. of a resin in which the substitution or addn. occurs in the hydrocarbon radical. Cf. C. A. 19, 1625.

Apparatus for determining the burning and flashing points of petroleum oils. C. PETTELE. U. S. 1,554,993, Sept. 29. Oil to be tested is placed in a groove within a horizontal cylinder of uniform cross-section, one end of the cylinder is heated and the oil adjacent this heated end is ignited. The temps. of the oil at points along the groove where it is burning and flashing are noted.

Apparatus for cracking and distillation of petroleum oils. L. C. HUFF. U. S. 1,555,976, Oct. 6.

Apparatus adapted for distillation of petroleum oils. M. J. TRUMBLE. U. S. 1,555,531, Sept. 29.

Apparatus for continuous distillation of crude petroleum or similar oils. J. F. BLAISE. U. S. 1,552,980, Sept. 8.

Petroleum still of the column type. S. T. SMITH. U. S. 1,556,132, Oct. 6. The still is adapted for distg. gasoline (from natural gas) after its absorption in oil.

High-pressure still for distillation of petroleum oils. W. F. SCHANZLIN. U. S. 1,555,761, Sept. 29.

Petroleum oil still. F. M. HESS. U. S. 1,552,698, Sept. 8.

Preheater for petroleum stills. H. A. HILLS. U. S. 1,552,433, Sept. 8.

Apparatus for separating oil and gas in wells. J. COULTER. U. S. 1,554,842, Sept. 22.

Gas trap for treating oil from wells. M. J. TRUMBLE. U. S. 1,554,471, Sept. 22.

Apparatus and procedures for making electric conductivity tests in oil wells, etc. F. W. HUBER. U. S. 1,555,800-1-2-3, Sept. 29.

Apparatus for separating water from gasoline, etc. J. ZWICKY. Brit. 232,287, Dec. 17, 1923.

Emulsions for binding fuels and for other purposes. J. C. MORRELL. U. S. 1,556,005, Oct. 6. The fluidity of emulsions is regulated by blending different emulsions of asphalts and oils or other material of relatively different fluidities.

Purifying oils. P. T. SHARPLES and L. D. JONES. Brit. 231,877, April 2, 1924. Used lubricating oils from internal-combustion engines, etc., are purified by centrifuging or by treating the oil in finely dispersed condition with air or gas or "oxidizing or chemical agents."

Purifying oil. L. H. CLARK. U. S. 1,553,141, Sept. 8. Impure oils such as used transformer or lubricating oils contg. finely divided C are treated with NaOH soln. or other aq. alk. reagent sufficiently dil. that H_2O -sol. impurities and reaction products will be in soln. in the aq. phase formed and the mixt. is subjected to centrifugal sepn.

Lubricants. M. J. HEITMANN. Brit. 232,259, April 10, 1924. Lubricants for axles of trucks and other machinery are formed of solid mineral oil contg. up to 50% or more of H_2O which may be emulsified with the oil by use of polymerized oils such as "voltol," wool fat, wool fat alcs., and montan wax. The emulsion may be prepd. by atomization or by use of steam.

Lubricant. A. E. BECKER and L. D. HISLOP. U. S. 1,552,669, Sept. 8. *A lubricant comprises Na naphthenate, petrolatum, still wax and H_2O , in various proportions.

Oil mixture containing camphor. J. A. YOUNG. U. S. 1,555,899, Oct. 6. A compn. adapted for lubricating leaf springs, etc., is formed of camphor 1 dissolved in a mixt. of lubricating oil 8 and crude petroleum 23 parts.

Apparatus for distilling diluents from crank case oil by use of heated air. E. J. HALL and C. A. WINSLOW. U. S. 1,555,664, Sept. 29.

Distilling bituminous schist, asphalt or lignite. SOC. LYONNAISE DES SCHISTES BITUMINEUX. Brit. 231,453, March 26, 1924. Distn. is effected by internal heating in a vertical cylindrical retort to which gas, steam and air are admitted to maintain a reducing atm. in the retort.

23—CELLULOSE AND PAPER

CARLETON E. CURRAN^{*}.

Dispersoidological investigations. IV. Dispergation and aggregation in general and particularly in their application to cellulose. P. P. VON VEIMARN. *Reports Imp. Ind. Research Inst., Osaka, Japan* 5, No. 18, 7-185(1925); cf. *C. A.* 18, 926.—V.'s work, which is actually a monograph on dispergation and aggregation, is divided into 4 parts. (1) a general part that is largely theoretical (pp. 7-107); (2) an exptl. part; (3) a brief program of further investigations on cellulose (pp. 171-6); (4) and an appendix (pp. 179-85) giving a translation of D. R. P. 275,882(1921), outlining a method for the conversion of celluloses of all kinds into plastic or gelatinous masses or into colloidal solns. Part (1) gives in detail V.'s views on dispergation. A dispersoidal ppt. of a solid substance is a ppt. made up of individual crystals of a size smaller than 200μ . These individual crystals may be in the form of unordered or orientated aggregates, such as threads, flakes, fibers, etc., that may be microscopic or macroscopic in size. V. discusses the chem. compn. and purification of ppts., and points out that "one cannot be cautious enough in accepting the various deductions made on the ground of the classical methods of pure chemistry, concerning the chem. formula of cellulose as a chem. individual." Until cellulose crystals can be grown to microscopic size at least, no purification will be sufficient to permit adequate investigations on the chem. constitution of cellulose. Tentatively, however, V. accepts Herzog's X-ray data indicating that celluloses of various origins contain largely one and the same chem. individual. Fibers of various kinds of cellulose are regarded as aggregate particles, consisting of minute ultramicro-crystals, probably rhombic, which are present in an axial arrangement more or less parallel to each other. The superficial layers of these crystals are probably contaminated with extraneous material, as are the ultramicro-pores of the fibers. The dispersoidological properties of the various cellulose fibers depend upon: the dimensions of individual ultramicro-cryst. particles, the firmness of the bonds holding these particles together, the degree of orientation of these particles, and the nature and concn. of the impurities present in the fiber. Part (1) also takes up the mechanism of the general dispergation process as applied to (a) molecularly or atomically non-homogeneous crystals; (b) crystals in which the vectorial structure is deranged; and (c) aggregates of crystals. The mech. dispergation of different types of cellulose (with illustrations of various types of dispergators = colloid mills) are discussed in detail. To obtain the best results with dispersoid mills, cellulose should be allowed to swell in water or in salt solns., and should then be disintegrated at -80° , or below. Very slight dispergation of cellulose, usually less than 0.01%, but at times 0.1%, may be caused by mechanically shaking S. and S. filter-mass No. 292 with 2 l. of distd. H_2O for 1 hr. V. has shown by ultraphotomicrographs that solns. show the Brownian movement. Preliminary expts. also show that cellulose may be partially dispergated by aq. solns. contg. 0.08 mols. of Na citrate per l. V. reiterates his former statement that all readily sol. salts will serve to dispergate cellulose provided the proper conditions of temp. and pressure are maintained. V.'s concepts of adsorption and solvation are also given in some detail. Dispersoidal "parasitism" may be manifested in cellulose solns., when products of cellulose decompn., which are more readily dispersed than the unmodified cellulose, act as dispergators for the cellulose particles. The fact that these initial decompn. products are also dispersoids was shown by ultramicroscopic examn. of their solns. V. discusses general aggregation processes, and then takes up the case of dispersoidal cellulose solns. Two extreme types of cellulose solns. exist: (a) solns. yielding elastic continuous jellies, (b) solns. failing to produce an aggregatory effect or gradually yielding ppts. consisting of aggregate particles. These types are connected by intermediate transition forms. Type (a) is discussed very fully with special reference to process of formation, structure and properties. Cellulose jellies that have been washed to remove salts, shrink rather rapidly, become denser, and acquire increased tensile strength. When dried completely the jelly becomes brittle, but still preserves its tensile strength. Transition from cellulose jellies to plastics (ointment-like masses) is dependent on the concn. of products of cellulose hydrolysis in the gels. Beyond a certain concn. of such products, the properties of jellies change from elastic systems into the region of plastic masses. The exptl. part (2) is in part a résumé of older work, including some of the fragmentary expts. carried out in Russia in 1911-13. Priority is again claimed for the work on thiocyanates usually accredited to Williams (*C. A.* 16, 340). Earlier work on the dispergating action of NaCl and BaCl₂ was repeated more carefully and confirmed. In each set of expts. a large excess of the salt was added to 200 cc. H_2O in which were

suspended 4 g. S. and S. No. 292 cellulose tablets. The sealed flasks contg. the cellulose-salt mixts. were gradually heated between 105° and 182°. In the case of NaCl, intensive dispersion was noted at 180°. With BaCl₂ pronounced dispersion began at a somewhat lower temp. Partial hydrolysis set in, in either case, and the hydrolysis products were amicroscopic and formed very stable sols. Ultramicroscopic examn. of sols. and ppts. indicate that some of the cellulose particles are certainly of dispersoidal size, and the ppt. may in part be dispergated with hot or cold water, thus forming cellulose sols having low salt concns. A large part of the cellulose dissolved in the concd. salt sols. is pptd. in gelatinous form, sepg. on the crystd. salts. V. has also shown that 5-6 g. cellulose may be readily dispergated at 160° by 100 cc. of satd. aq. LiCl, and that the soln. deposits snow-white flakes of cellulose. If the concn. of cellulose is raised to 10-12 g. per 100 cc. of LiCl soln., a viscous deep brown soln. is obtained which sets to a jelly pierced with LiCl crystals. (Exptl. conditions are given in great detail.) 100 g. of Ca(CNS)₂ soln. satd. at 50° readily dispergated 2 g. cellulose at 105°, forming a pale transparent jelly on cooling. If 8 g. of cellulose are used, and the heating is continued to 125-35°, a very dark but firm and elastic jelly is obtained after cooling. Heating above this point leads to soap-like ointments. Dwindling of elasticity of the jelly is so gradual that it becomes impossible to draw a line between a jelly and a semi-solid ointment. Numerous ultraphotomicrographs of the various sols, ppts., fibers, jellies and ointments are included. Dispersoidal sols. of cellulose contg. degradation products may be formed by treating cellulose ppts. deposited from concd. salt sols., and washed nearly free from salts, with boiling H₂O. The aq. layer above the cellulose may be decanted off after standing 42-66 hrs., and this operation repeated with each cellulose residue until a number of successive "disperse systems" have been obtained. A well defined dispersion max. occurs in such a series. At this max., the cellulose soln. shows the most pronounced bluish white opalescence of any prepn. of the series, and the cellulose and salt concns. are exceedingly low. A cellulose ppt. obtained from a concd. LiCl soln. was dispergated by a series of treatments with boiling H₂O, and 14 successive sols. were prepd. Of these the 9th prepn. (cellulose concn. = 0.08 g. per l.; LiCl, 0.07 millimol. per l.) showed the dispersion max., and was also shown to be the most stable soln. of the series. When concd. sols. that have been heated under pressure with cellulose are poured into H₂O, to yield a medium salt concn., and allowed to stand for several months, the supernatant liquid is yellow and exhibits a bluish white opalescence, which may or may not be susceptible of differentiation into sep. particles. These sols. also have a marked reducing action in dil. sols. of Ag and Au salts, and yield very stable and highly disperse sols. of dispersoidal Ag and Au. V. gives conditions for the prepn. of such sols. in daylight and in partial darkness, and describes their properties in minute detail. V. points out that at room temp. and in complete darkness, the yellow sols. may fail to exert any reducing action on Ag halides, but might render Ag salts very sensitive to light. (This has not been proved by expt.) The porosity and absorption capacity of a cellulose gel prepd. from Ca(CNS)₂-cellulose soln. showed that a white elastic ball of cellulose jelly could be washed practically free from salt by H₂O, followed by treatment with alc. The cellulose gel was finally treated with Et₂O and dried over H₂SO₄. When 7 g. of cellulose were used in the prepn. of a gel, the dried gel weighed 7.3 g. and had a diameter of 5 cm., and resembled dried gluten in consistency. It absorbed 700% of its dry wt. of H₂O, without recovering its original wet vol. (approx. 150 cc.), and while still manifesting a wrinkled surface. The dried cellulose ball showed a cabbage-head structure, and was apparently built up of cellulose plates, placed one over the other. V. **Quantitative study on cellulose dispersion in aqueous solutions of Ca(CNS)₂ saturated at room temperature and at 50°.** P. P. VON VEIMARN AND S. OTSUKA. *Ibid* 189-200.—Ca(CNS)₂ sols. were prepd. by satg. at 20° (room temp.) and at 50°. Cellulose (S. and S. tablets) in carefully weighed amts. was allowed to remain in contact with these sols. and the mixts. were then heated at a definite temp. until complete dispergation (as detd. by the ultramicroscope) had taken place. Time-temp. dispergation curves were constructed for sols. contg., resp., 2, 4, 5, 6 and 8 g. of pure cellulose in 100 cc. of soln., and also for sols. contg. 2 and 4 g., resp. of sulfite pulp. The latter failed to give transparent sols. and the rate of dispergation was much slower than that of pure cellulose. The rate of dispergation increases with increasing temp., and decreases with increasing amts. of cellulose. A 2% soln. of cellulose in Ca(CNS)₂ satd. at 20°, may be obtained at 90° in about 7 hrs. and at 110° in less than 2 hrs. The rate of dispergation of the cellulose depends also on the previous treatment of the sample; e. g., if a sample was previously shaken during 24 hrs., it could be completely dispergated at 80°. The following data give, resp., the wt. of cellulose taken, and the time and temp. of complete dispergation, using 100 cc. of

Ca(CNS)₂ solns. satd. at 20°: 4 g. in 4.5 hrs. at 100°, 3 hrs. at 110°, 3 hrs. at 120°; 5 g. in 6 hrs. at 100°, 4 hrs. at 110°, 4 hrs. at 120°; 6 g. in 8 hrs. at 100°, 5.5 hrs. at 110°, 5 hrs. at 120°; 8 g. in 7 hrs. at 110°, 6 hrs. at 120°. The following are similar data obtained with pure cellulose using 100 cc. of Ca(CNS)₂ satd. at 50°: 4 g. in 4 hrs. at 100°, 1.5 hrs. at 110°, 1 hr. at 120°; 10 g. in 4 hrs. at 120°, 1.5 hrs. at 130°. Each soln. was carefully explored with the ultramicroscope, and numerous photomicrographs and ultraphotomicrographs are given. LOUIS E. WISE

Evolution of celluloid and of nitrocellulose collodions. A. BRÉGUET. *Rev. gén. colloïdes* 3, 200-6, 230-5(1925).—The changes taking place in celluloid and in nitrocellulose (A) collodions with time and after treatment with heat and with ultra-violet light, were studied by fractional pptn. of A by Duclaux and Wollmann's method (C. A. 14, 3154), using C₆H₆ instead of H₂O to prevent pptn. of the camphor, and detn. of the wt., viscosity and N content of the various fractions. The results are interpreted in the light of Duclaux' theory of the constitution of reversible gels (C. A. 17, 1567), as follows: in a collodion the most complex A mols. have the greatest tendency to polymerize and swell; and in an A sol the solid phase (cellular network) is formed of the largest granules, the cells of which are filled with a dispersion of the finer granules in the solvent. The granules of collodion are in equil. with the solvent, and in time the cohesion forces of the mols. in the granules gradually diminish, and the granules are progressively depolymerized with resultant decrease in swelling. This is manifested by decrease in viscosity. This aging does not proceed indefinitely, but tends to a limit which depends on the concn., temp. and also on the nature of the A. Aging is accelerated by heat, light and mechanical treatments. The changes taking place in collodion with time are thus due to its changing from an emulsoid to a suspensoid. The above conclusions are applicable in their entirety to celluloid and particularly to cinematographic films, which consist merely of a highly concd. solid dispersion of A in camphor. A. PAPINEAU-COUTURE

Bleaching chemical wood pulp. L. DEMARS. *Mon. papeterie belge* 5, 475-85, 541-58(1925).—General and fairly detailed discussion of the purpose, mechanism and methods of carrying out pulp bleaching operations. A. PAPINEAU-COUTURE

Starches as pasting materials. H. M. GRASELT. *Paper Ind.* 7, 900-1(1925).—Brief description of the prepn. of starch pastes for use on paper pasting machines. A. PAPINEAU-COUTURE

Recent research of the U. S. Bureau of Standards. B. W. SCRIBNER. *Paper Trade J.* 81, No. 13, 51-6(1925).—A brief description of investigations on paper testing, manuf. and specifications recently completed or in progress at the present time. A. PAPINEAU-COUTURE

Hydrogen-ion concentration in the paper mill. M. B. SHAW. *Paper Trade J.* 81, No. 10, 59-62(1925).—An explanation of the meaning of p_H and of its colorimetric detn., with an account of tests carried out at the Bur. of Standards paper mill, showing its importance in *paper sizing*. Max. pptn. of alum occurs at p_H of 5.0-5.5, depending on the parts per million of alum used. By regulating the p_H of the stock in the beater after pptg. the size, the alum consumption in the mill has been reduced by 33%. The use of H₂SO₄ to produce the proper p_H does not give satisfactory sizing. A certain amount of colloidal Al hydroxide, supplied by alum, is required for effective sizing, but the amount is min. at the optimum p_H value. The quantity in excess of that required to produce this value apparently has no favorable effect on the sizing quality of the paper. A. PAPINEAU-COUTURE

Indicators for the pulp industries. F. ÖMAN. *Pulp Paper Mag. Can.* 23, 981-4, 1011-2, 1016, 1035-6, 1059-60(1925).—See C. A. 19, 2743. A. P.-C.

Paper making woods of other Dominions. ANON. *Pulp Paper Mag. Can.* 23, 1101-3(1925).—A discussion of the suitability for pulping of the most important woods of Australia, New Zealand and India. A. PAPINEAU-COUTURE

Esparto as a paper making material. M. B. SHAW, G. W. BICKING AND R. R. RUMSEY. *Paper Trade J.* 81, No. 12, 55-6(1925).—Lab. and semi-com. pulping tests were carried out on esparto "semi-pulp" now available on the American market. Best results were obtained with 5% NaOH (on the wt. of grass), and the fiber obtained was appreciably stronger than soda pulp and approached sulfite in strength. In order to obtain a clean sheet, free from specks and shives, it was necessary to clean the pulp mechanically before cooking. The lab. cooks (without dusting) gave 73-8% yields, and the semi-com. cooks (with dusting) gave 57-63% yields. A. P.-C.

Bamboo and grasses for paper pulp. W. RAITT. *World's Paper Trade Rev.* 84, 562-8, 618-20(1925).—A detailed description of R.'s "fractional" boiling process for the pulping of bamboo and grasses (C. A. 8, 247; 11, 1546; 16, 1012) with a discussion

of its merits. With *sabai grass* the fractional process reduces NaOH consumption from 15 to 11.5%, cooking temp. from 145° (45 lbs. pressure) to 136° (32 lbs. pressure), time from 4 hrs. to 3.5 hrs., bleach consumption (on the wt. of grass) from 6 to 1.75%, spent liquor from 1400 gal. at 5.5° Tw. to 900 gal. at 11° Tw., and gives 2% higher yield of bleached pulp. Similarly, with bamboo, fractional boiling reduces NaOH consumption from 21 to 15%, cooking temp. from 162° (80 lbs.) to 140° (38 lbs.), bleach consumption from 10 to 5%, and spent liquor from 1600 gal. at 6° Tw. to 1000 gal. at 10.5° Tw., and increases the yield of bleached pulp by 3%. Practical hints are given on the prepn. of bamboo for pulping, more particularly as regards splitting and crushing, and "seasoning" under water to remove a considerable proportion of its starchy constituents which facilitate molding and attacks by insects.

A. PAPINEAU-COUTURE

New method of cooking straw for strawboard. J. D. RUE AND W. H. MONSSON. *Paper Trade J.* **81**, No. 15, 52-3(1925).—Digestion of straw with a soln. of Na_2CO_3 and Na_2SO_3 gives a higher yield of a product which possesses less odor, has superior phys. properties, contains less ash and more cellulose and is more resistant to the action of 1% NaOH than the product obtained by the ordinary CaO process. The most favorable proportions of chemicals are 7.5 lbs. Na_2CO_3 and 1.5 lbs. Na_2SO_3 per 100 lbs. of straw. Recovery of the Na_2O is not economically necessary but can be applied. The cost of the new product may be up to \$3.13 per ton greater than that of straw pulp produced by the CaO process; but the difference in most cases would be much less or would be compensated for by higher yields and improved quality. A. P.-C.

Proposal for reducing the contamination of streams by strawboard mills. J. D. RUE AND F. G. RAWLING. *Paper Trade J.* **81**, No. 15, 48-9(1925); cf. preceding abstract.—Recovery of the Na_2O in the Na_2CO_3 - Na_2SO_3 process will eliminate most of the stream pollution. As only about 25% of the SiO_2 in the straw is dissolved out by this process, it would not cause trouble in incineration, nor in the settling of the sludge as the black ash is not causticized. From a discussion of the cost of the recovery process, R. and R. conclude that the additional cost of the product will not be prohibitive, specially in view of the demonstrated superiority of the strawboard produced.

A. PAPINEAU-COUTURE

Evaporating black liquor. R. W. MACGREGOR. *Paper Trade J.* **81**, No. 14, 57-8(1925); *Paper Mill* **49**, No. 40, 10, 46(1925).—Brief discussion of the advantages of multiple effect vacuum evaporators over disc evaporators for the concn. of black liquor.

A. PAPINEAU-COUTURE

Colored back water and two sidedness in paper mills. J. R. ROBERTS. *Paper Trade J.* **81**, No. 14, 55-6(1925); *Paper Mill* **49**, No. 40, 12, 42(1925).—Both the color of the back water and the evenness of color of the 2 sides of the sheet depend to a large extent on the retention of the dye or pigment by the stock, and the troubles are largely or wholly overcome by sufficiently increasing the affinity of the dye for the fibers. The following will help reduce the trouble: select direct dyes if possible, use salt and heat in the beaters, with double deck driers shut off the steam from the first one or two driers which the bottom (or wire) side of the sheet strikes. Practically every case must be studied separately owing to differences in the conditions prevailing in different mills.

A. PAPINEAU-COUTURE

Testing method for degree of sizing paper. F. T. CARSON. *Paper Trade J.* **81**, No. 15, 47(1925); cf. C. A. **19**, 175.—A comparative study was made of the ink flotation, electrolytic or conductivity (2 types), Stockigt, curl and Bureau of Standards new indicator methods for detg. degree of sizing. Exptl. data obtained on 63 samples of paper appear to justify the following conclusions: (1) The most probable relative degrees of internal sizing of the various samples tested are best represented by the data of the Bureau of Standards indicator method. (2) The agreement between the indicator method and the curl method is in general satisfactory. (3) The Stockigt method is fairly dependable, but there is attached an element of uncertainty which at times may involve gross error. (4) Neither the electrolytic method nor the ink flotation method corroborates any other method, nor can these methods be depended upon to give consistent or reasonable comparative data even on the same kind of paper. A. P.-C.

Cellulose xanthates. R. WOLFFENSTEIN AND E. OESER. *Kunstseide* **1**, 2-5, 27-31, 74-8(1925).—By treating acetone-sol. cellulose acetates with NaOH and then CS₂ according to the technical methods of viscose manuf., a product named *cellulose dithionate* may be obtained which differs from the ordinary form in that the ppt. obtained by diln. with EtOH is dark brown and gummy, and further contains about 45% cellulose. It is believed that under the conditions 5 OH groups of the cellulose mol. are made reactive. The compd. is less stable than the common xanthate, the de-

compn. of metallic derivs. being particularly rapid. The secondary increase in viscosity of viscose solutions on ripening is apparently caused by the sepn. of cellulose. E. R. CLARK

Utilizing waste gases from cookers in the cellulose industry. H. KOCH. U. S. 1,554,581, Sept. 22. Waste gases such as are evolved from cookers in which cellulose material is digested with sulfite soln. are subjected to elec. pptn. at a temp. sufficiently high to prevent condensation of H_2O , in order to sep. org. substances such as aromatic compds.

Reinforced cellulosic sheets. E. C. NOONAN. U. S. 1,550,041, Aug. 18. A roll of wire netting is submerged in a body of paper pulp to fill its meshes, withdrawn and passed over a rotating heated roll.

Cellulose derivatives, etc. L. LILIENFELD. Brit. 231,807, April 4, 1924. Cellulose derivs. sol. in aq. alkalis but insol. in H_2O and in the usual org. solvents are obtained by acting on cellulose or an alkali-insol. cellulose conversion product with a halohydrin such as α -monochlorohydrin or ethylene chlorohydrin in the presence of an alkali soln. The products are inert, resistant to alkalis, and are suitable for the manuf. of threads, films, etc.

Cellulose oxy-alkyl and hydroxy-alkyl ethers and compositions made therefrom. L. LILIENFELD. Brit. 231,808, April 4, 1924. Oxy-alkyl and hydroxy-alkyl cellulose ethers such as are produced by the process of Brit. 231,807 (cf. above) are used in the manuf. of coatings, sizes, artificial leather, cements, thickening agents for pigments in textile printing, plastic compns., films and artificial threads. The ethers may be used in alkali soln. and may be mixed with other colloids and softening agents such as hydrated cellulose or hydrocellulose sol. in alkalis, viscose, albuminous substances, proteins, gelatin, amyloid, starch, dextrin, gums, pectins, tragacanth, resins and resinous condensation products sol. in alkalis, shellac, glycerol, diglycerol, polyglycerol, glycols, sugars, sirups, soaps, fats and NH_4 or alkali metal derivs. of fatty sulfonic acids such as Turkey-red oil.

Cellulose ethers, etc. L. LILIENFELD. Brit. 231,809, April 4, 1924. Cellulose derivs. insol. in H_2O but sol. in aq. alkalis are prepd. by carrying out the treatment of cellulose or a cellulose conversion product insol. in alkali, with a monohalogen fatty acid or a salt or ester of such an acid, and alkali, without the use of alc. or with the use of not more than 20% as much alc. as H_2O . Details of proportions and strengths of reagents are given and among the acids which may be used are: monochloroacetic acid, α -bromopropionic acid, bromosuccinic acid, α -bromoisobutyric acid. The products may be pptd. from the reaction mixt. by use of an acid, acid salt or alc. and may be used for the manuf. of transparent threads or films or other products. Brit. 231,810 specifies a similar process in which an alc. is used and in which the mol. proportion of halogen fatty acid to caustic alkali used is not more than 0.5:1, e. g., 0.3:1. Brit. 231,811 specifies the use of cellulose derivs. such as are obtained according to Brit. 231,809 in the manuf. of a large variety of compns. and mixts. for threads, films, coatings, adhesives, artificial leather, etc.

Cellulose derivatives. L. LILIENFELD. Brit. 231,800, April 4, 1924. A cellulose xanthic acid or xanthate is treated with a halogen fatty acid or with one of the salts, esters or derivs. of such an acid, e. g., $ClCH_2CO_2H$, $CH_3CHBrCO_2H$ or $C_2H_5CHBrCO_2H$. The products are either sol. in H_2O , sol. in aq. solns. of NH_3 and of aliphatic and aromatic bases or in aq. solns. of caustic alkalis and are suitable for making threads and films. Brit. 231,801 specifies treating these products (either in a unitary operation with their formation or subsequently as a sep. step) with compds. such as $PhNH_2$, o - $CH_3C_6H_4NH_2$, $EtNH_2$, Et_2NH , $MeNH_2$ or $PhCH_2CH_2NH_2$. The products are insol. in H_2O , alc. or ether but are sol. in dil. caustic alkali and in aq. NH_3 solns. and in org. solvents such as pyridine, aniline and chlorohydrins, "especially in aq. soln." Brit. 231,802 specifies the use of NH_3 instead of the amines used according to Brit. 231,801. The products obtained with NH_3 are insol. in H_2O but sol. in aq. alkalis and are suitable for making strong threads or films.

Products from cellulose derivatives of xanthic and fatty acids. L. LILIENFELD. Brit. 231,805, April 4, 1924. Compds. as produced according to Brit. 231,800 (cf. above) are used for the manuf. of finish coatings, sizes, artificial leather, cements, thickening agents for pigments in textile printing, plastic compns., films and threads. The cellulose deriv. may be used as an aq. soln. or with volatile basic substances such as NH_3 , or members of the guanidine, pyridine or quinoline groups. Various fillers, coloring materials and other auxiliary ingredients are specified for various purposes.

Molded and other articles from substituted cellulose thiourethans. I. LILIENFELD. Brit. 231,806, April 4, 1924. Substituted cellulose thiourethans such as are obtained by the process of Brit. 231,801 (cf. above) are used in the manuf. of substitutes for celluloid, ivory, glass, horn, ebonite, tortoise-shell, wood, paints or lacquers, resins and resin substitutes, films, artificial silk, adhesives, printing rollers and hectographic masses, artificial leather and finishes for cloth and paper. Numerous examples are given of mixts. with a large variety of auxiliary and modifying ingredients for making mixts. for the specified and other purposes.

Cellulosic esters. P. BERTHON. U. S. 1,553,924, Sept. 15. Hydrocellulose is mixed with palmityl chloride (dild. in CHCl_3) or other acid chloride of the acylic org. acids contg. more than 5 C atoms, an org. base such as pyridine or quinoline is added, the materials are heated, the cellulose ester formed is pptd., *e. g.*, by adding alc., and is washed and dried.

Cellulose esters and ethers. SOC. CHIMIQUE DES USINES DU RHONE. Brit. 231,837, April 2, 1924. A rotary drum without fixed internal agitating devices is used for making cellulose esters and ethers and balls, rolls or the like may be loosely placed in the drum to facilitate mixing.

Cellulose ether composition. S. J. CARROLL. U. S. 1,552,792, Sept. 8. A cellulose ether, *e. g.*, the Et ether (insol. in H_2O), is homogeneously mixed, in unpptd. form, with resorcinol diacetate to form a compn. adapted for making films.

Cellulose ether compositions for films, etc. S. J. CARROLL. U. S. 1,552,793, Sept. 8. Resorcinol is used with cellulose ethers such as the H_2O -insol. Et ether, the ingredients being mixed in unpptd. form. U. S. 1,552,794 specifies Et acetanilide instead of resorcinol. U. S. 1,552,795 (H. T. CLARKE) specifies pentaerythritol tetraacetate. U. S. 1,552,796 (J. M. DONOHUE) specifies Et lactate. U. S. 1,552,797 specifies C_6H_6 and acetone. U. S. 1,552,798 specifies benzyl chloride or other "aliphatic halide deriv. of toluene". U. S. 1,552,799 specifies a bromo-nucleo benzenoid substitution product such as $\text{C}_6\text{H}_5\text{Br}$, $\text{C}_6\text{H}_4\text{Br}_2$ or monobromotoluene. U. S. 1,552,800 specifies acetylacetone. U. S. 1,552,801 specifies hexyl acetate. U. S. 1,552,802 specifies cannone. U. S. 1,552,803 specifies hydroquinone diacetate or other acetic ester of a polyhydroxybenzene. U. S. 1,552,804 specifies Pr, Bu or Am butyrate. U. S. 1,552,805 specifies a carbonic ester of a lower monohydroxy aliphatic alc. such as Et carbonate. U. S. 1,552,806 specifies Me formate.

Crinkling and "delustering" cellulose ester fibers. H. DREYFUS, J. F. BRIGGS and H. R. S. CLOTWORTHY. U. S. 1,554,801, Sept. 22. Threads or fibers of cellulose acetate or similar material are treated with a reagent such as hot H_2O or NH_4CNS soln. to give them the effect of wool, hair, etc.

Solvents for cellulose esters, etc. M. OW-ESCHINGEN and E. PFIFFNER. Brit. 231,161, March 24, 1924. Oily liquid residues obtained in the distn. of crude "wood alk." are used as solvents for nitrocellulose, acetylcellulose, cellulose ethyl ether, etc., after a redistn. or fractionation. Nonsolvent fractions may be mixed with MeOH, EtOH or $\text{C}_6\text{H}_5\text{Cl}$ to form solvent mixts.

Nitrocellulose composition. W. M. JOHNSON. U. S. 1,554,505, Sept. 22. A plastic non-inflammable nitrocellulose compn. is formed of a celluloid mass mixed with a lesser proportion of a mixt. contg. CaCl_2 2, NaOAc 1, alum 1, Na borate 1 part and a camphorated alc. soln.

Compositions of nitrocellulose or other cellulose esters. E. E. REID. U. S. 1,554,033, Sept. 15. A neutral Bu phthalate, *e. g.*, di-(normal) Bu phthalate, is used as "modifier" or softener with nitrocellulose or other cellulose esters in forming compns. adapted for making films, artificial leather, lacquers, etc.

Reducing the viscosity of nitrocellulose solutions. G. C. BAGON. U. S. 1,553,494, Sept. 15. Nitrocellulose is heated in the presence of a liquid such as mixed EtOH and C_6H_6 which possesses a low solvent power, to render the nitrocellulose sol. in the liquid and form a soln. adapted for use as a *varnish or lacquer*. U. S. 1,553,495 specifies embedding nitrocellulose in a body of sand or other substantially dry protecting and heat-transmitting medium and then subjecting the embedded material to heating, at a temp. of about 60–100° or higher, to reduce its viscosity when dissolved in solvents such as alc and C_6H_6 .

Dehydrating nitrocellulose. J. H. HASTR. U. S. 1,552,807, Sept. 8. Washed nitrocellulose is treated with alc. to remove H_2O and then treated with monochloronaphthalene, which serves to lessen the fire risk in handling the material.

Paper pulp manufacture. V. BERNOT and P. R. FOURNIER. U. S. 1,553,976, Sept. 15. Mech. features.

Apparatus for bleaching paper pulp. A. D. MERRILL. U. S. 1,556,235, Oct. 6.

Tough long-fibered paper impregnated with rubber. K. L. MOSSES. Brit. 230,994, March 22, 1924.

Coating paper with nitrocellulose compositions containing metal powder. J. MARSHALL. Brit. 231,180, March 18, 1924.

Deinking paper. E. KELLNER. U. S. 1,555,674, Sept. 29. Waste paper to be reworked is pulped at about 75°, treated with Na_2CO_3 , heated to about 90° and mixed, then treated with "chloride of lime" and S, again heated for a short time and washed.

Apparatus for recovery of values from waste waters of paper manufacture. V. ANTOINE. U. S. 1,554,943, Sept. 22.

Paper-making apparatus. R. S. CLARKE. U. S. 1,552,594, Sept. 8.

Translucent film. C. H. DASHER. U. S. 1,552,422, Sept. 8. Films adapted for making bottle caps, artificial flowers, etc., are formed of cellulose regenerated from viscose mixed with cementing viscose.

Lignone derivatives. C. F. CROSS. U. S. 1,553,220, Sept. 8. Sol. lignone derivs obtained by treatment of lignocellulosic materials with SO_2 are treated with an oxidizing agent such as chromic acid to produce substances which may be used for sizing or filling wood. Cf. C. A. 19, 1348.

Carbon pigment. S. F. WALTON. U. S. 1,552,973, Sept. 8. The black ash residue of the soda process of wood pulp manufacture is treated, e. g., by sedimentation and flotation in H_2O , to remove the lighter and heavier portions and leave a carbonaceous residue which is then ground to form a pigment.

24—EXPLOSIVES AND EXPLOSIONS

CHARLES E. MUNROE

Nephelometry, and a suggested sensitive test for the stability of explosives. A. F. C. POLLARD. *Trans. Opt. Soc.* 26, 63-73(1924-5); *J. Soc. Chem. Ind.* 44, 614B. The rate of decompn. of propellent explosives at atm. temp. is measured by sweeping off the accumulated N peroxides with a current of air. This air is to be passed through a colloidal soln. of Ag_2O contained in one tube of a Kingslake nephelometer (*Trans. Optical Soc.* 26, 53-63), and the disappearance of the colloidal particles due to the action of the N peroxides is followed by the reduction of the scattered light, the amt. of which is measured by the movement of the standard tube necessary to restore optical equality in the photometric field. The tests are carried out at intervals not exceeding 10 hrs., the amt. of N peroxide accumulated during the interval being thus measured.

CHARLES E. MUNROE

Connecting blasting caps with fuse. M. LUPUS. *Z. ges. Schiess-Sprengstoffw.* 20, 116-7(1925).—A description of a patented connector which eliminates danger in crimping caps onto fuse with the usual type of crimper.

C. G. S.

Explosions of hydrogen-oxygen mixtures. W. NORMANN. *Chem.-Ztg.* 49, 757 (1925).—An electrolytic O_2 plant found that the delivery pipes had been crossed and the gases mixed. No accident occurred because the error was discovered in time. Tests were then made to det. the effectiveness of wire gauze in preventing flash-back. A small gasometer was filled with a 2:1 mixt. of H_2 and O_2 and the gas delivered through a small flask filled with H_2O to a Fresenius tube 1 cm. wide, 6 cm. long, in the center of which were a number of Cu gauze screens fitting the side walls closely. This safety tube is effective with a H_2 -air mixt., but only prevented flash-back with H_2 - O_2 mixts. when a certain velocity was not exceeded, this velocity depending upon the fineness of the gauze. It is therefore not a dependable safety device for this purpose.

E. M. SYMMES

The initiation of explosives. OTTO SCHULZE. *Z. ges. Schiess-Sprengstoffw.* 20, 113(1925).—Expts. showed that direct contact of elec. detonators or blasting caps with dynamite charges is not essential for complete detonation of such charges. A charge of 100 g. of 60% nitroglycerin dynamite was loaded in an Fe pipe 25 mm. diam., 75 mm. long and 3 mm. thick, capped at its bottom end, the pipe filled with water, and a No. 8 detonator exploded in the water. The dynamite detonated with the detonator at a distance of 40 cm. The pipe was bulged opposite the position of the detonator and demolished at its lower end by the explosion. When the water was replaced by air detonation occurred with a still greater gap between the dynamite and the detonator (55 cm.), and in a vacuum the max. effective distance was 40 cm. With less sensitive explosives or with weaker detonators, detonation was obtained only at shorter distances, e. g., with an NH_4NO_3 explosive contg. 4% nitroglycerin, the effective gap in water was reduced to 2 cm., even with a No. 8 detonator.

C. G. STORM

Detonation limits in explosive gas mixtures. RUDOLF WENDLANDT. *Z. physik. Chem.* 116, 227-60(1925); cf. *C. A.* 18, 3115.—Detonating reactions are characterized by high condensation behind the flame and a high velocity of propagation. In long tubes the velocity of detonation is independent of the length of the path, the materials used for the walls of the tube, the cross section of the tube, etc., but is characteristic for each mixt. Upon diluting a detonating mixt. the velocity of detonation finally suffers a sudden decrease at a certain diln. Thus in a H_2 -air mixt. such a crit. condition occurs with the H_2 content between 18 and 19%. This is due to the relationship of pressure, time necessary for reaction, temp., cond. of the gases concerned, etc. A thermodynamic theory of limiting conditions is based upon the work of Riemann-Hugoniot, Jouguet, Le Chatelier, Dixon and others; exptl. results for mixts. of H_2 -air, CO-air, CO_2 and other detonating gases are assembled, plotted and discussed; and illustrations are given of the ways in which the equations and data can be employed in calcs., affording information concerning even regions that cannot be studied by exptl. methods.

W. C. EBAUGH

The influence of some inflammable vapors of organic liquids on the limits of inflammability of mixtures of inflammable gases and air. IV. The influence of dichloro- and trichloroethylene on the limits of inflammability of carbon monoxide-air mixtures. W. P. JORISSEN AND J. H. A. P. LANGEN VAN DER VALK. *Rec. trav. chim.* 44, 810-3 (1925). (In English).—Previous results (J. and Meuwissen, *C. A.* 19, 2274) showed that $(CHCl)_2$ lowered both explosion limits of mixts. of NH_4 + air, CO + air, C_2H_2 + air and H_2 + air. This paper is an extension of the CO + air expts. Air satd. with $(CHCl)_2$ was stored in a thermostat and used to make the mixts. The upper and lower explosion limits of CO + air at 14° in the modified app. were 15.35 and 72.72%, resp. With 5% $(CHCl)_2$ vapor the limits were 6.65 and 50.25%; with 10% $(CHCl)_2$ vapor 1.8 and 27.8%; with 12% 1.95 and 16.5%; with 14% 0.75 and 7.6%; with 16% 1.75 and 3.7%. The final limit was found at 16.6% $(CHCl)_2$ vapor and 2.5% CO which were the limiting concns. of explosibility of both components. With 2% $CHCl_3$ vapor and CO + air the upper and lower limits were 18.95 and 52.75%, resp. With 3% $CHCl_3$ the upper limit was 43.55%, lower limit not detd.; with 4% the lower limit was 21.45%, upper limit not detd. Similar data are being developed with CH_2Cl_2 , $MeCl$ and CH_4 . The expts. demonstrate the importance of an investigation on the possible explosion limits of so-called noninflammable liquids and the influence of small amts. of inflammable gases on these limits. V. The influence of trichloroethylene on the limits of inflammability of hydrogen-air mixtures. W. P. JORISSEN AND B. L. ONG-KUOHONG. *Ibid* 814-7.—Previous expts. (*C. A.* 19, 2274) showed that the upper and lower explosion limits of H_2 + air mixts. can be lowered by C_2HCl_3 . The expts. were extended. With H_2 + air alone the limits were 6.3 and 61.3% at 14° ; with 3% C_2HCl_3 vapor they were 5.9 and 43.3%; with 6.05% C_2HCl_3 (satd. vapor) the limits were 4.9 and 25.9%. With H_2 + air alone the limits were 5.9 and 62.3% at 25° ; with 3% C_2HCl_3 the limits were about as at 14° ; with 5% C_2HCl_3 the limits were 5.1 and 42.9%; with 10.84% C_2HCl_3 (satd. vapor) the limits were 5.1 and 20.8%. With H_2 + air alone the limits were 6.1 and 63.1% at 35° ; with 3% C_2HCl_3 6 and 47.2%; with 6% C_2HCl_3 4.7 and 41.1%; with 10% C_2HCl_3 4.2 and 34.9%; with 14% C_2HCl_3 6.7% was the lower limit; with satd. C_2HCl_3 vapor (15.7%) no explosions were obtained with 4.0 to 20.0% H_2 . The ratio of H_2 to O_2 was calcd. for all of the expts. and also shows the lowering of the lower explosion limit by C_2HCl_3 vapor. The lowering of the lower limit increases with the temp. Other work of this sort is underway.

E. J. WITZEMANN

Gaseous combustion at high pressures. V. The explosion of H-air and CO-air mixtures at varying initial pressures up to 175 atmospheres (BONE, *et al.*) 21. Isopropyl aromatic amines [for stabilizing explosives] (U. S. pat. 1,555,451) 10.

Explosive. J. EHRLICH. U. S. 1,550,064, Aug. 18. The Na salt of sulfanilic acid or other salt of an org. aminosulfo acid is used with other components of explosives such as oxidizing salts or nitro compds.

Liquid air explosive. G. WEBER. U. S. 1,555,806, Sept. 29. Liquid air is used with a combustible metal powder such as Al, Sb, Mg, Fe, Si or silicides and with inert and combustible absorbent substances such as cork flour, saw dust, soot and hydrocarbons.

Propellant explosive powder. J. B. FIDLAR AND C. R. FRANKLIN. U. S. 1,552,601, Sept. 8. Nitrocellulose is used together with a colloiding explosive such as nitroglycerin, hydrocellulose and a stabilizer, *e. g.*, urea or diphenylamine.

Furnace for burning explosive charges from fuses and percussion caps of artillery ammunition. G. ALLISON. U. S. 1,549,896, Aug. 18.

Priming composition. W. FRIEDERICH. U. S. 1,552,836, Sept. 8. A priming mixt. suitable for general use with explosives is prepd. by slowly pouring solns. of alkali metal azides and of alkali metal salt forming nitro compds., such as Na azide and Na picrate, into solns. of Pb salts such as Pb nitrate.

Smoke material for "sky writing." J. C. SAVAGE. Brit. 231,826, April 3, 1924. A material for producing red smoke comprises 10 lbs. of orange oil sol. aniline dye, 1 gal. of light mineral lubricating oil and 1 pint of $C_2H_2Cl_4$ or CCl_4 . For green smoke, the orange oil sol. aniline dye is mixed with synthetic indigo. It is used for purple smoke and "anthracene" for black or gray smoke.

25—DYES AND TEXTILE CHEMISTRY

L. A. OLNEY

The science of dyeing. H. F. HEERMANN. *Proc. Am. Assoc. Textile Chem. Colorists* 1925, 187-90; *Am. Dyestuff Rept.* 14, 659-62; cf. C. A. 19, 896.—The functions of chromophores and chromogens in the formation of dyes are discussed. L. W. R.

Dyeing of artificial silk. E. K. PALMER. *Ind. Chemist* 1, 133-6(1925).—Details are given for the manuf. of the different kinds of artificial silk, and for the special precautions to be observed in dyeing these fabrics. L. W. RIGGS

Cotton dyeing. R. K. PALMER. *Ind. Chemist* 1, 398-9(1925).—The general characteristics of direct cotton colors, vat dyestuffs, sulfur colors, basic colors, azo colors, primuline red and the ingrain colors, aniline black and the mineral colors are described, and the usual methods of application to cotton outlined. The equipment employed and the plant methods employed for loose dyeing, silver dyeing, yarn dyeing and piece dyeing are briefly dealt with. E. G. R. ARDAGH

Swelling of raw cotton hairs during mercerization without tension. MARY A. CALVERT and FREDERICK SUMMERS. *J. Textile Inst.* 16, 233-68T(1925).—The unit of mercerization is the single cotton hair, a plant product of great variability. The relation between the mercerized and unmercerized hair width was examd. in 38 world cottons and the results are shown in 23 tables. The cuticle of the hair sets a limit to the amt. of swelling in the outward direction. L. W. RIGGS

"Lanolinification" of cotton, permanent dressings. ED. JUSTIN-MUELLER. *Bull. soc. ind. Mulhouse* 91, 399-400(1925); Sealed Note 2221 of Jan. 1, 1913.—"Lanolinification" is a treatment giving to cotton the feel of wool and the permanent stiffness of flax fibers, consisting in impregnating the dyed, bleached or merely boiled fiber (yarn or fabric) with a soln. of albumin contg. a sol. oil, paraffin or stearin with a suitable solvent, and CH_2O , letting stand overnight in a moist condition, steaming 15-20 min. without previous drying, passing through a bath of an Al salt, rinsing, washing and drying. Steaming fixes the albumin, and the CH_2O gives a much softer feel, like that of wool. Report. JACQUES LEONHART. *Ibid* 400-1.—L. found the above treatment to give the feel of flax, but did not observe the action claimed for CH_2O . Sol. oil and paraffin, rather than CH_2O , gives a soft feel. The process is not applicable to white goods, as they yellow on steaming. The process cannot compete commercially with Heberlein & Co.'s concd. H_2SO_4 process, evolved during the war. A. P.-C.

New process of dyeing wool with alizarin black WX extra. RENÉ HARTMAN. *Bull. soc. ind. Mulhouse* 91, 402-3(1925); Sealed Note No. 1706 of Feb. 9, 1907.—The soly. of the dye is increased by adding $NaHSO_3$, and HCO_2H is added to obtain proper exhaustion of the bath without deterioration of the fiber or excessive decomposition of the $NaHSO_3$. The HCO_2H required for complete exhaustion of the dye bath increases with the amount of $NaHSO_3$ which must be added to dissolve the dye. Process for dyeing with alizarin black WX extra. Sealed Note No. 1712 of Feb. 28, 1907, *Ibid* 404-5.—Improved fastness to rubbing and more complete exhaustion of the dye bath are obtained by using $(NH_4)_2SO_4$ instead of $AcOH$ and Na_2SO_4 in the dye bath. Report. VERNIER. *Ibid* 405-6.—V. was able to confirm H.'s claims, and could find no priority. A. PAPINEAU-COUTURE

Some causes of staining of woollen goods. H. LAGACHE. *Tiba* 3, 909-17(1925).—A discussion of the effects of air, light, acids, alkalis, yeasts and molds, and frost on wool, from the standpoint of staining during dyeing or finishing. A. P.-C.

Removal of stains and spots in finished goods. T. JOHNSON. *Am. Dyestuff Rept.* 14, 664-5(1925).—Stains are caused (1) by dirty app., (2) by action of solns. on

metals or wood used in the construction of app., (3) by water conditions, particularly hard water. Procedures for avoiding stains are emphasized. L. W. RIGGS

Bleaching agents. R. BÜRSTENBINDER. *Seifensieder Ztg.* 52, 655-6(1925).—Polemical against Heermann (cf. *C. A.* 18, 3485) in regard to O_2 -contg. bleaching agents for laundrying. P. ESCHER

The fading of colored materials by daylight and artificial light. M. LUCKIESH AND A. H. TAYLOR. *Am. Dyestuff Rept.* 14, 613-8, 637(1925).—The effect of various factors, such as illumination intensity, spectral character of the radiation, temp., humidity, etc., were studied with silk ribbons. The av. results of tests on 23 ribbons show that exposure to sunlight and skylight at 3900 foot-candles for 11 hrs., or to skylight alone at 450 foot-candles for 40 hrs., will cause as much fading as exposure to 500 foot-candles from tungsten lamps for 100 hrs. Also that approx. equal degrees of fading will result from exposures to W filament radiation for 100 foot-candle-hrs., skylight for 34 foot-candle-hrs., or sunlight and skylight combined for 77 foot-candle-hrs. L. W. R.

Isopropyl aromatic amines [for making dyes] (U. S. pat. 1,555,451) 10. Isopropyl-*p*-aminophenol [for dyeing furs] (U. S. pat. 1,555,452) 10.

Dyes. E. B. HIGGINS and BRITISH SYNTHETICS, LTD. Brit. 230,920, Dec. 19, 1923. Amides of *o*-hydroxycarboxylic acids, such, *e. g.*, as the product obtainable from the di-Na or K salt of 2,3-hydroxynaphthoic anilide by treatment in alc. with pyridine methyl iodide, yield azo dyes when coupled with diazo compds. either in substance, on substrata or on the fiber. Various examples are given.

Dyes. FARBENFABRIKEN VORM. F. BAYER & Co. Brit. 231,532, March 31, 1924. Dyes giving yellow to red shades on cotton from a vat are prepd.: (a) by nitrating a dianthraquinonyl diamide such as di- α - or β -anthraquinonyl-urea or -succindiamide, reducing and aroylating; (b) by condensing an α -nitroaminoanthraquinone (2 mols.) with a dibasic acid or its anhydride or chloride, reducing and aroylating; (c) condensing an α -aroylaminoaminoanthraquinone (2 mols.) with a dibasic acid, etc.; (d) condensing an α -aroylaminoanthraquinonyl-monoamide of a dicarboxylic acid with an aminoanthraquinone; (e) condensing 1 mol. of a dibasic acid dichloride first with 1 mol. of an α -aroylaminoaminoanthraquinone and then at a higher temp. with 1 mol. of a second α -aroylaminoaminoanthraquinone. Specific examples are given.

Dyes. SOC. ANON. POUR L'IND. CHIM. A. BÂLE. Brit. 231,688, May 6, 1924. Aminoanthraquinone derivs. which dye vegetable fiber from the vat orange to brown or olive shades are produced by further condensation, with other substances, of the condensation product made by condensing 2 mols. of cyanuric chloride with 1 mol. of 1,5-diaminoanthraquinone or 1,8-diaminoanthraquinone or a mixt. of both. Numerous examples are given.

Dye. SOC. ANON. POUR L'IND. CHIM. A. BÂLE. Brit. 231,555, Nov. 29, 1923. A dye, dyeing cotton from a vat in green-blue shades fast to Cl, is made by caustic alkali fusion of 2-aminoanthraquinone-3-carboxylic acid, which may be carried out in the presence of an "organic flux" such as alc., paraffin oil, aniline, xyldine or anisidine and then purifying the product, *e. g.*, by dissolving in strong H_2SO_4 and reprecip., or by other specified purification methods. Brit. 231,574 specifies producing the dye by treating 2-aminoanthraquinone-3-carboxylic acid with an oxidizing agent (*e. g.*, with MnO_2 and H_2SO_4) and purifying the product as in Brit. 231,555.

Dyes. SOC. ANON. POUR L'IND. CHIM. A. BÂLE. Brit. 232,251, April 9, 1924. Bordeaux to blue and black azo dyes are formed, in substance or on the fiber, by coupling tetrazotized diaminoazo compds. with 4-hydroxynaphthalene-1-aryl-ketones. Numerous examples are given.

Dyes. FARBWERKE VORM. MEISTER, LUCIUS & BRÜNING. Brit. 232,230, April 9, 1924. Dyes of the symmetrical indigoid type which produce red to violet shades on cotton are made: (1) by heating an α -anil of a substituted 2,3-diketodihydrothionaphthene with a substituted arylthioglycol-*o*-carboxylic acid in the presence of Ac_2O , with or without a diluent; or (2) by condensing (with or without a diluent) an acylated oxythionaphthene, made by treating an arylthioglycol-*o*-carboxylic acid with Ac_2O , with an α -anil of a 2,3-diketodihydrothionaphthene. Numerous examples are given.

Dyes. FARBWERKE VORM. L. DURAND, HUGUENIN & Co. Brit. 231,889, April 4, 1924. Esters of leuco compds. of vat dyes (*e. g.*, leuco thioindigo red) are treated with chlorosulfonic alkyl esters (*e. g.*, the Et or Me ester in the presence of pyridine). The products are in general less sol. and more readily isolated than the acid sulfuric esters described in Brit. 186,057 (*C. A.* 17, 343).

Dyes. H. PEREIRA. Brit. 232,262, April 10, 1924. Perylene or its derivs., *e. g.*, dibenzoylperylene, is heated with a P sulfide, preferably in the presence of a diluting agent such as kieselguhr. On oxidation the products yield other dyes of a sulfonic character and on treatment with S and a sulfide S dyes are obtained. Green, red and orange colors are produced on cotton or wool by various of the specified dyes.

Dyes. H. PEREIRA. Brit. 232,263, April 10, 1924. Vat dyes are prepd. by heating nitro derivs. of perylene with anhyd. AlCl_3 . Dinitro- and tetranitro-perylene both yield dyes producing olive shades on cotton. Dinitroperylene is obtained by treating perylene dissolved in CCl_4 with HNO_3 without heating.

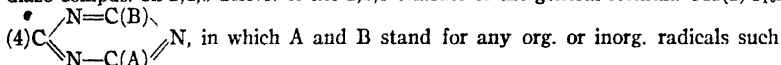
Dyes. H. PEREIRA. Brit. 232,265, April 10, 1924. In the condensation of dibenzoylperylene or other perylene compds. by the use of AlCl_3 , oxidizing agents such as MnO_2 , Fe_2O_3 , FeCl_3 , Cu oxide, KNO_3 and Ni sulfate are added to alter the character of the dye produced or to increase the yield obtained. Numerous examples are given.

Dyes. H. PEREIRA. Brit. 232,266, April 10, 1924. Perylene is halogenated by the action of halogen in the nascent state, *e. g.*, H_2O_2 is slowly added to a suspension of perylene in glacial HOAc contg. Na bromite, to form a dibromo compd. which is pptd. and can be recrystd. from PhNO_2 . Vat dyes dyeing cotton yellow to brown are obtained by various similar reactions which are described.

Azo dyes. H. WAGNER. U. S. 1,549,822, Aug. 18. Various diazo compds. are combined with 2,3-hydroxynaphthoic acid anilide in which the anilide ring is substituted in the 2-position by halogen and in the 5-position by alkyloxy, aryloxy or aralkyloxy groups. Numerous examples are given.

Azo dyes and lakes. FARBWERKE VORM. MEISTER, LUCIUS & BRÜNING. Brit. 231,529, March 29, 1924. Azo dyes are produced, either in substance or in the form of lakes or upon the fiber, by coupling with 2,3-hydroxynaphthoic arylides the diazo compds. of 2-amino-4-arylamino-1-alkyloxy- or -aralkyloxy-benzenes not contg. a free hydroxyl, sulfonic or carboxylic group, *e. g.*, 2-amino-4-benzoylamino-1-anisole and its derivs. Cf. C. A. 19, 3024.

Triazine azo dyes. G. BONHOTE. U. S. 1,549,901, Aug. 18. Dyes are formed by the reaction of diazotized 4-chloro-2-aminobenzene-1-phenyl ether or other unsulfonated diazo compds. on 2,4,6-derivs. of the 1,3,5-triazine of the general formula $\text{OH}(1)\text{C}_6\text{H}_6$,



OH or NH_2 . Dyes giving yellowish red to blue and black are obtained.

Disazo dyes. FARBENFABRIKEN VORM. F. BAYER & Co. Brit. 231,885, April 4, 1924. Disazo dyes are produced by coupling diazotized *m*-aminobenzeneazosalicylic acid or homologs or derivs., with 1-acidylamino-8-naphtholsulfonic acids. They may be used for printing red shades on cotton with Cr acetate. The *m*-aminobenzeneazosalicylic acids are prepd. by coupling diazotized *m*-nitroanilines or acidyl-*m*-phenylene diamines with salicylic acids and reducing or saponifying.

Thioindigoid dyes. FARBWERKE VORM. MEISTER, LUCIUS & BRÜNING. Brit. 231,567, Dec. 22, 1923. Thioindigoid dyes are produced by halogenating the 2,3,2',3'-bisanaphthothiophene-indigo or the dyes made by condensing 2,3-naphthoxythiophene with reactive α -derivs. of isatin, or by use of suitable components one or more of which contains a halogen. Numerous examples are given. Cf. C. A. 19, 1058.

Chromium compounds of dyes. SOC. ANON. POUR L'IND. CHIM. A BÂLE. Brit. 231,446, March 28, 1924. Cr compds. of dyes, which dye wool fast levelling tints, are made by interaction of a triphenylmethane dye which can be chromed (*e. g.*, Eriochromazurol B, Eriochromcyanine R or Chrome violet) and a Cr compd. of an azo dye which can be chromed, *e. g.*, the Cr compds. of the azo dye from 1-amino-2-hydroxynaphthalene-4-sulfonic acid and α - or β -naphthol. These compds. may be formed directly on the fiber.

Dyes for cellulose acetate, etc. R. TONKIN, J. THOMAS, E. G. BECKETT AND SCOTTISH DYES, LTD. Brit. 231,206, Sept. 14, 1923. The diphthalimidoanthraquinones described in Brit. 214,765 (C. A. 18, 2715) are nitrated, the products are hydrolyzed and treated with alkali metal sulfide, to produce dyes which appear to be hexaamino-dianthraquinonylthioethers which dye cellulose acetate or wool blue.

2-Amino-1-hydroxynaphthalene-8-sulfonamide-4-sulfonic acid. SOC. ANON. POUR L'IND. CHIM. A BÂLE. Brit. 231,149, March 20, 1924. 1,8-Naphthsultone is sulfonated, nitrated or nitrosated, treated with NH_3 and then reduced. Its diazo compd., when coupled with other usual components, yields mordant dyes which may be converted into sol. metal compds. with Cr or Cu compds. The products dye wool

orange, brown, red, blue, violet, etc. and may be used in printing. Numerous examples are given.

Condensation products from hydroxybenzenesulfonic acid. P. VIRCK. U. S. 1,553,014, Sept. 8. Colorless compds. contg. S and capable of being absorbed by textile fibers for use as mordants for basic dyes are obtained by heating a hydroxybenzenesulfonic acid with a resinous product produced by the action of S chloride on a hydroxybenzene, *e. g.*, phenol.

Dyeing. A. ESCHACH and J. P. WORMS. Brit. 231,209, Oct. 22, 1923. Animal or vegetable fibers are dyed by oxidizing phenols, amines or their salts by the action of persulfate together with a metallic salt or oxide. Numerous examples are given of processes producing different colors.

Dyeing. DURAND ET HUGUENIN SOC. ANON. Brit. 231,189, March 20, 1924. In dyeing cotton, mercerized cotton, viscose or other textile material with esters of leuco vat dyes as described in Brit. 186,057 the affinity of the fiber for the esters is increased by adding a salt such as NaCl or Na₂SO₄ to the bath.

Dyeing apparatus. C. JENSEN. U. S. 1,555,673, Sept. 29.

Printing cellulose acetate. SOC. ANON. J. R. GEIGY. Brit. 231,897, March 31, 1923. Aromatic sulfonic or carboxylic acids or their salts are added to the printing paste, or the cellulose acetate goods are impregnated with these compds. before being printed. A printing paste may, *e. g.*, comprise setoglausine, 2-naphthol-7-sulfonic acid, HOAc and a gum thickening. Various sulfonic acids of benzene, naphthalene or anthraquinone, or salicylic acid, or oxy-, alkyl-, chloro- or nitro- derivs. of these may be used. Cf. C. A. 18, 2433.

Dyeing cellulose acetate. SOC. ANON. POUR L'IND. CHIM. A BALE. Brit. 231,455, March 31, 1924. Cellulose acetate goods are dyed violet, green, blue and black shades with mono azo dyes contg. one or more diazotizable amino groups, the shades being diazotized and developed with alkyl- or aralkyl- α -naphthylamines. Numerous examples are given.

Dyeing cellulose acetate. R. CLAVEL. U. S. 1,549,906, Aug. 18. In dyeing films, artificial silk, etc., of cellulose acetate, at least one of the components to be coupled, *e. g.*, dianisidine-HCl, is applied in the presence of MgCl₂ or other sol. chloride and of a protective colloid, *e. g.*, gelatin, soap or "boiled-off liquor" which serves to prevent pptn.

Titanous salts for use in dyeing, etc. S. F. W. CRUNDALL, W. B. LLEWELLYN, H. SPENCE, and P. SPENCE & SONS, LTD. Brit. 230,877, Oct. 11, 1923. Citric, tartaric, oxalic, lactic, or succinic acid, Na or Ca citrate, Na oxalate or other org. acid or salt is added to a titanous salt of an inorg. acid during its use in soln. for stripping or discharging dyes. The org. acids may be partially substituted for the inorg. acid in prep. the soln. and the soln. may be concd. until it becomes solid or semi-solid on cooling. Al₂(SO₄)₃ facilitates the solidification.

Apparatus for dyeing and scouring yarn, etc. J. BOARDMAN AND HUNT & MOSCROP, LTD. Brit. 230,954, Jan. 19, 1924.

Apparatus for dyeing and scouring wool, etc. J. BOARDMAN, E. W. HUNT AND HUNT & MOSCROP, LTD. Brit. 230,953, Jan. 19, 1924.

Apparatus for dyeing or scouring yarn in hanks or skeins. H. M. DUDLEY. U. S. 1,555,837, Oct. 6.

Duplex apparatus for dyeing warps on beams. B. K. THIES. Brit. 232,494, Sept. 18, 1924.

Artificial silk. A. KÄMPF. Brit. 232,200, April 12, 1924. Viscose silk or the like, especially that made from unripened alkali cellulose, is subjected to a vacuum treatment for removing CS₂, before the usual washing and immediately after spinning.

Artificial silk. R. FRANKL. Brit. 232,219, April 10, 1924. Mech. features of "drawing-out" of threads spun from viscose solns. into an acid sulfate soln. contg. free acid.

Artificial silk from viscose. W. J. STEVENSON. U. S. 1,556,174, Oct. 6. See Brit. 225,135 (C. A. 19, 1952).

Apparatus for forming artificial silk. C. SANDOZ. Brit. 232,482, Aug. 29, 1924.

Washing artificial silk. H. LUMMERZHEIM. U. S. 1,553,252, Sept. 8. Spools of artificial silk are subjected to a relatively short preliminary washing with H₂O forcibly applied mechanically and then immersed for a longer time in a body of H₂O which is renewed until the washing is completed.

Waterproofing fabrics. A. H. PENFIELD. U. S. 1,549,798, Aug. 18. After washing threads, yarn or similar material with soap soln., it is subjected to the action of an

elec. current in a soln. of $Al_2(SO_4)_3$, freed from surplus soln. and dried at about 70–80° before being woven into fabric.

Waterproofing composition. W. F. CRAWFORD. U. S. 1,554,715, Sept. 22. A compn. for waterproofing and mildewproofing textile materials is prepd. by mixing paraffin, wool grease, linseed oil, coloring material and gasoline and heating the mixt. to the b. p. during mixing.

Waterproofing compositions. E. GERMANN. Brit. 231,367, July 10, 1924. A compn. for application when melted to waterproof and color textile fabrics, etc., comprises ceresin, stearic acid, paraffin, japan wax and fat, mixed with a mineral pigment. Wool grease treated with Al acetate may be used, as may also tallow and rosin.

Silky and elastic finish on vegetable fabrics. L. LILIENFELD. Brit. 231,804, April 4, 1924. Cotton or other vegetable fabrics are treated with a halohydrin and with an alkali, e. g., with α -monochlorohydrin, epichlorohydrin or ethylene chlorohydrin and with NaOH. Numerous details and statements of auxiliary treatments are given.

Imparting luster and stiffness to vegetable fabrics. L. LILIENFELD. Brit. 231,803, April 4, 1924. Fabrics made of vegetable fiber are stiffened or given a silky luster (or both) by simultaneous or successive treatment with alkali (e. g., a 10–40% NaOH soln.) and with monochloroacetic acid, α -bromopropionic acid, α -bromobutyric acid or bromosuccinic acid or a similar monohalogen fatty acid. The materials may be given a preliminary treatment, e. g., by boiling with dil. alkali soln., bleaching or mercerizing or by treatment with a gelatinizing or hydrolyzing agent such as strong inorg. acid, ammoniacal Cu oxide or thiocyanate solns.

Composition for finishing textile materials. J. F. MOSELEY. U. S. 1,554,919, Sept. 22. A mixt. comprising bentonite and $MgSO_4$ or other neutral sulfate is used for finishing, together with china clay and starch or other usual filling materials.

Scouring and bleaching textile materials. E. T. J. WATREMEZ. Brit. 231,454, March 28, 1924. Ordinary scouring or bleaching agents such as NaOH or NaOCl solns., used on cotton, linen or other cellulosic materials, are mixed with a soln. obtained by dissolving a metal oxide such as Al_2O_3 in a hot concd. soln. of an alk. salt such as Na_2CO_3 .

Bleaching animal, vegetable and artificial fibers. C. PHILIPP, R. FEIBELMANN and R. HALLER. U. S. 1,554,461, Sept. 22. The fibers are treated with a salt of an aromatic sulfohalogenamide, e. g., chloramine-T.

Batik. M. SCHLOZ. U. S. 1,553,721, Sept. 15. See Brit. 214,507 (C. A. 18, 2610).

Composite yarns of wool and flax. SOC. A. DESCAMPS. Brit. 231,432, March 27, 1924.

Apparatus for bleaching textile materials with ozone. F. E. HARTMAN and H. B. HARTMAN. U. S. 1,553,042, Sept. 8.

Mercerizing yarns. L. A. STREAD. U. S. 1,554,532, Sept. 22. Mech. features

Apparatus for mercerizing yarn. T. MCCONNELL. U. S. 1,555,864, Oct. 6.

Yarn-sizing apparatus. G. F. SLIPP. U. S. 1,553,403, Sept. 15.

26—PAINTS, VARNISHES AND RESINS

A. H. SABIN

Chemical Foundation patents on liquid coating compositions. H. A. GARDNER. Paint Manufs. Assoc. of U. S., *Circ.* No. 249, 75–88(1925).—A list by name, title number, and first claim, of all patents in the liquid coating compn. group owned by the Chem. Foundation, Inc., and available for license to Am. manufs. F. A. WERTZ

The painting of ships. R. G. BROWNING. *J. Oil and Colour Chem. Assoc.* 8, 173–81(1925).—An historical review of the use of anti-fouling and anti-corrosive compns., and of the general paint requirements of ships. F. A. WERTZ

Suggestions relating to paste paint compositions and reductions. H. A. GARDNER. Paint Manufs. Assoc. of U. S., *Circ.* No. 245, 51–3(1925).—Pigment concn. in the film plays a very important part in the durability of paints. In reducing paste paints it is, therefore, desirable to use the proper liquids: too much oil and lack of proper driers will produce soft, dirt-collecting films; a high percentage of volatile thinner produces a more durable paint in hot, moist climates. F. A. WERTZ

A pigmented non-drying rust protective for temporary work. H. A. GARDNER. Paint Manufs. Assoc. of U. S., *Circ.*, No. 246, 54–8(1925).—A pigmented slushing compd. consisting of heavy petrolatum 50 lbs., Zn dust 30 lbs., Al powder 2 lbs., mineral

spirits 5 lbs. has the advantage that its more rigid consistency makes it less subject to sagging at high temp.; the Zn content affords added protection; and the Al adds brilliancy and good appearance. Abstracts of the specifications for clear rust preventive compds. of the Federal Specifications Board are appended. F. A. WERTZ

Wood fillers and undercoatings. SEDLACZEK. *Farben-Ztg.* 30, 2796-8, 2865-6 (1925).—A review of patented and other formulas. F. A. WERTZ

Casein in the decorative painting of walls. HUGO KÜHL. *Farben-Ztg.* 30, 2629-30 (1925).—Review. F. A. WERTZ

Driers. FELIX WILBORN. *Farben-Ztg.* 30, 2665-7 (1925).—Review. F. A. W.

Driers. H. RASQUIN. *Farben-Ztg.* 30, 2603-4 (1925).—A summary of a thesis on the action of driers in the manuf. of oil varnishes, FERD. PALLAUF, Tech. Hochschule München (1924). The drying of linseed oil occurs through autoxidization. The increase of drying properties imparted to an oil on mixing with metallic oxides occurs only after the formation of soaps. Preference for metallic linoleates or resinates lies largely on their solys. Only insignificant differences were shown in the drying strength of Co linolenate, linoleate, oleate, and palmitate; Pb linolenate was not as effective as the oleate, and the palmitate was decidedly poorest because of its lower soly.; the Mn soaps were ranked in the same order.¹ Tungstates are not as practical driers as linoleates or resinates. Drying time plotted against the amt. of drier present produces a hyperbolic curve. On varnishes contg. Co, Pb, Pb-Mn, or Mn driers, the drying time decreased by almost exactly half for each 10° increase in temp. detd. over the range 0-50°. The metals in decreasing order of drying effectiveness are Co, Mn, Ce, Pb, Fe, Cu, Ni, V, Cr, Ca, Al, Cd, Zn, Sn. The final increase in wt. on drying of oils contg. Pb, Mn, or Co driers is essentially the same, but the induction period varies. The concn. of Pb-Mn for optimum drying should not exceed 0.6% and in the proportion of Pb:Mn = 3:8:1. In the manuf. of boiled oil the use of PbO is preferred to Pb₂O₄ or PbO₂. The decreased drying properties of old varnishes occur through pptn. of the driers. Some graphs are given. F. A. WERTZ

Possible production of titanium white from Canadian sources. H. A. LEVERIN. *Can. Chem. Met.* 9, 198-9 (1925).—A brief review of the American and Norwegian processes for making Ti pigment, and of its properties, is given. The ilmenite deposits in the Provinces of Que. and Ont. contain 34 to 44% TiO₂; this is somewhat lower than the ores used in the U. S. Typical analyses are given. A recently developed process which promises to produce Ti white at a low price consists in reducing the ore to sponge Fe. Most of the Fe is then leached out with FeCl₃ and the resultant FeCl₂ is used to produce electrolytic Fe. The residue consists of 77 to 80% TiO₂, 7 to 10% Fe, and the remainder gang; this is treated with H₂SO₄ for the ultimate production of Ti white. F. A. WERTZ

Universal colors for the paint industry. MARTIN SEIDEL. *Chem.-Ztg.* 49, 697-8 (1925).—Attempts have been made to reduce the no. of pigments necessary to produce a complete variety of paints in all colors, by the adoption of a series of 10 to 12 "universal" pigments based on the fundamental spectral colors. Such pigments must be lime-proof, H₂O-proof, non-bleeding in oil, and permanent to light. Examin. of several com. universal pigment series showed that they failed in certain requirements; a suggested series which does comply with the requirements consists largely of org. toners and lakes, whose present prices prohibit their general com. use. F. A. WERTZ

The drying of materials in the color industry. REHNUS. *Farben-Ztg.* 30, 2477-80, 2553-4, 2608-11, 2741-3, 2809-10 (1925).—A brief general description of the operation of filter presses, centrifuges, driers, etc. F. A. WERTZ

Lithopone. A. EIBNER. *Farben-Ztg.* 30, 2600-2 (1925).—An historical review of the gradual improvement in the light resistance of lithopone which has accompanied a decrease in the impurities present. F. A. WERTZ

Other-soluble sulfur in ultramarine. T. H. BARRY. *J. Oil and Colour Chem. Assoc.* 8, 202-4 (1925).—The quantities of free S in a large no. of European ultramarines of all possible colors, detd. by extn. with Et₂O, are tabulated; and the color measurements on the extd. pigment are compared with the original. The free S in ultramarines of good quality is invariably less than 1%, and it does not appear to have any material influence on the color or the permanency of the pigment, but quantities in excess of 1% may possibly have some effect. Re-extg. samples after 2 yrs. shows no further S, so that it appears that S is not liberated from ultramarine during storage. Cf. C. A. 14, 635. F. A. WERTZ

Unproductive use of the German chamber method in most white lead works. GUSTAV ARNOLD. *Chem.-Ztg.* 49, 594-5 (1925).—The production of highest grade basic carbonate white lead which is as free as possible from the normal carbonate requires

the production of a true basic Pb acetate as the initial step in the process. This is not accomplished in most chamber processes because of failure to observe proper concns. of AcOH, temps., etc. The vapors of not to exceed 6% AcOH should be led into the chamber with plenty of air for the first few days and the temp. should not exceed 40° CO₂ should not enter the chamber until large amts. of basic Pb acetate have been formed and as the temp. subsequently rises to a max. of 75 or 80°, the concn. of the AcOH used should be gradually reduced to a max. of 0.6% at the end of the process. Antiquated washing, drying and grinding methods should be discontinued. F. A. WERTZ

The permanency to light of pigments, and its determination in natural and artificial light sources. H. WAGNER. *Farben-Ztg.* 30, 2991(1925).—The quartz-Hg vapor lamp gives the same final bleaching effect as sunlight in $1/5-1/30$ of the time. The type and quantity of vehicle used in the test influence the results. F. A. WERTZ

The evaluation of white pigments. P. WOLSKI. *Farben-Ztg.* 30, 2993(1925).—The brightness of a dry white pigment is detd. by direct comparison with a standard series representing 100 to 90% abs brightness. An index of the hiding power in oil is the amt. of lampblack necessary to reduce the brightness to 50% of the original brightness as detd. by measurements with a shadow photometer. The measure of the spreading rate in oil is the area which when painted with 1 kg. of pigment on a black undercoat will show a brightness of 50% of the original brightness. F. A. WERTZ

Test methods for rust-preventive paints. CARL BINGGELY. *Schweiz. Chem.-Ztg.* No. 13, 121-3(1925).—A polished steel plate is given 2 coats of the test paint which is allowed to dry 8 to 10 days. The panel is then exposed to steam for 10 to 12 hrs., dried at 100° for 1 hr., and a portion of the film removed with CS₂. No corrosion of the steel should have occurred. Another test method consists of placing 5% H₂SO₄ on 2 air-dried coats of paint over iron, allowing it to remain 24 to 48 hrs. and noting whether the paint blisters. These are the 2 most generally used tests, but they measure impermeability of the film and resistance to acid rather than rust-inhibitive properties. A convenient method for detg. the permeability is to have the Fe panel serve as one electrode, and a N-KCl soln. on the paint film as the other, and measuring the p. d. between them. Illus. (See C. A. 19, 3025.) F. A. WERTZ

A method for making paint and varnish films for testing. D. DAVIDSON. *Paint, Oil, and Chem. Rev.* 80, No. 11, 10(1925).—A measured vol. of varnish is placed on the center of a plate glass disk, and another similar disk is pressed down on it until the varnish covers the whole of the adjacent surfaces. The disks held in a vertical position are then slid apart, and the thickness of the film on each is calcd. If the films are to be stripped, one of the disks may consist of amalgamated brass, or may be covered with glue-sized paper. F. A. WERTZ

The determination of water in paints. T. H. BOWLES, T. H. ADAMS, C. A. KLEIN, AND J. A. F. WILKINSON. *J. Oil and Colour Chemists' Assoc.* 8, 206-8(1925).—For the detn. of H₂O in paints according to the specification of the British Eng. Standards Assoc., mix 100 g. of the sample in a flask with 100 cc. petroleum spirit, b. 80-100°, and 1 cc. of dry Am or Et acetate. Then attach the flask to the side arm of a special distillate receiver having a narrow graduated tube at the bottom into which the H₂O collects on distn., while the petroleum spirit returns through the side arm to the flask. Cf. C. A. 19, 2277, 2465. F. A. WERTZ

A new color standard for varnishes. S. C. ATKINSON AND B. C. JAMES. *J. Oil and Colour Chemists' Assoc.* 8, 208-9(1925).—The disadvantages of solns. of K₂Cr₂O₇ in concd. H₂SO₄, of caramel in H₂O, and of other solns. at present used for varnish color standards are discussed. A satisfactory standard is obtained by using a mixt. of 20 g. NiSO₄·7H₂O in 100 cc. H₂O, and 1.25 g. of I in 100 cc. H₂O. The amt. of KI present does not affect the final color. A definite vol. of the I soln. is measured into a beaker and the NiSO₄ soln. added until approx. the same shade as that of the varnish under examn. is obtained. The correct depth of color is then adjusted by the addn. of a measured quantity of H₂O. Comparison is made by viewing an equal vol. of the varnish and the soln., in tubes 1.1 cm. diam. Close matches are possible, and sealed tubes over 3 months old show no alteration in color. F. A. WERTZ

The examination of boiled linseed oil for rosin. HANS WOLFF. *Farben-Ztg.* 30, 2795-6(1925).—The Lieberman-Storch test for rosin in raw and boiled linseed oil is reliable only when the result is negative, but a positive color reaction is not an infallible indication of the presence of rosin. Jensen (Holde, *Die Kohlenwasserstofföle und Fette*, p. 605 (1924)) states that the Lieberman color reaction is more intense, the greater the amt. of unsapon. matter in the oil. Examn. of 78 raw oils showed that approx. half of those contg. more than 1.5% unsapon. matter gave positive reactions. The fatty acids of these oils, after sepn. of the unsapon. matter, gave a negative reaction

in nearly every case. When the raw oils were heated with driers, the resultant boiled oils showed an even higher percentage of positive reactions, especially in those containing Mn. The test for rosin is best carried out on the fatty acids; if the color reaction is positive, rosin is indicated only through formation of NH_4 abietate with its characteristic crystal form, and gel formation in benzene. A convenient procedure for making the test is given and results are tabulated.

F. A. WERTZ

The abrasion resistance of varnishes. W. C. ARSEM. Paint Manufs. Assoc. of U. S., *Circ.* No. 244, 45-50(1925).—The "abrasimeter" for measuring the abrasion resistance of varnish films, in its simplest form, consists of a steel ball bearing, three-sixteenth inch in diam. mounted at the end of a pointed wooden rod fastened to the right-hand pan of a trip scale. The wt. on the scale pan required to produce a scratch on a varnish film moved about under the ball is a measure of the abrasion resistance. The critical point on films of uniform thickness and degree of dryness can be detd. to within 5 to 10%. With this device it is possible to follow the progress of drying and hardening of a varnish, to compare different varnishes, and to show the effect of varying proportions and treatments. It is to be expected that the greater the continuity of the gel structure, resulting from the drying oil in the film, the greater the abrasion resistance. Results on several varnishes and lacquers are plotted. A great increase in abrasion resistance results when more than 75% of gel-forming substance is present, probably because of the proximity and particular arrangement of the mol. units of the gel.

F. A. WERTZ

Sediments in varnishes. FELIX WILBORN. *Farben-Ztg.* 30, 2862-3(1925).—Sediment in varnishes generally consists of insol. Pb or Mn salts of palmitic, stearic, or oxy fatty or resin acids; this is in accord with earlier reports (*C. A.* 16, 349). Investigation of complaints on unduly turbid varnishes during the winter traced the cause to the low temp. especially in combination with traces of moisture retained in the previously steamed-out barrels.

F. A. WERTZ

The production of oil varnishes with sulfur chloride. HANS BRENDL. *Farben-Ztg.* 30, 2734-5(1925).—The treatment of drying oils with SCl_2 to produce special varnishes is difficult to carry out, and the resultant products have no particular merits. Instead of being good rust-preventive coatings as often claimed, such varnishes may be corrosive because of the residual HCl which they contain.

F. A. WERTZ

The chemistry of drying oils. II. G. W. ELLIS. *Chemistry & Industry* 44, 463-ST(1925); cf. *C. A.* 19, 3380.—Linseed oil, oxidized to different degrees, was extd. with petroleum ether, and the insol. portion then dissolved in CCl_4 -alc. mixt., and fractionally pptd. with petroleum ether or with dil. alc. Ultimate analyses, acid and sapon. nos. of the products are tabulated; these indicate that hydrolysis of the oxidation product, due to the effect of the solvents employed, had taken place, and suggest the existence of isomeric forms of the same oxidized products. The process involving the soln. of linoxyn is the one liable to cause hydrolysis; when thoroughly dried solvents are used, the resultant purified linoxyn, representing 72.5% of the original oil film, shows an ultimate analysis which agrees well with the ascribed formula $\text{C}_{37}\text{H}_{50}\text{O}_{20}$. The acid no. of the purified linoxyn indicates monobasic acidity; I no. 12.1. Linoxyn in soln. readily reduces Fehling soln. and AgOH , and gives a blue coloration with KI-starch soln. acidified with AcOH .

F. A. WERTZ

Pyroxylin invades the varnish plant. ANON. *Chem. Met. Eng.* 32, 747-9(1925).—A description of the plant equipment, and the method of manufg. lacquers at the Beck-with-Chandler plant.

F. A. WERTZ

The stability of nitrocellulose. J. B. WIESEL. *Paint, Oil and Chem. Rev.* 80, No. 10, 8, 20, 21(1925).—A popular account of the rapidly growing field of nitrocellulose coatings, with particular reference to the importance of stability as regards permanence of the coating.

E. M. SYMMES

Bulking value of nitrated cotton in lacquers. Spreading rate of colored crushing lacquers and oil paints. Temperature of gasoline in painted tanks. H. A. GARDNER. Paint Manufs. Assoc. of U. S., *Circ.* No. 247, 59-61(1925).—One lb., dry basis, of nitrated cotton of any viscosity, when dissolved in lacquer solvents, "bulks" approx. 0.1 gal. Lacquers have a much lower spreading rate than oil paints. Results of comparative small panel tests are tabulated. Additional tests on the comparative temps. of gasoline tanks painted with white or with Al paint, made with small containers in the lab., indicate that white paint is more efficient in keeping the temp. low. Results are tabulated.

F. A. WERTZ

Tetralin, dekalin, hexalin as solvents and thinners. H. A. GARDNER. Paint Manufs. Assoc. of U. S., *Circ.* No. 248, 62-74(1925).—Hexalin is the only one of these

solvents that has any pronounced action on nitrocellulose. Abstracts from the literature on the products are appended. F. A. WERTZ

Nitrocellulose varnishes and varnish paints. Applications in the automobile and wood working industries. J. H. FRYDLANDER. *Rev. prod. chim.* **28**, 577-84(1925).—A review of recent progress in their manuf. and application. A. P.-C.

Colors for lacquers. A. F. BROWN. *Paint, Oil and Chem. Rev.* **80**, No. 10, 12, 21 (1925).—A review. In general the color found satisfactory for use in oleoresinous varnishes will be found adaptable to the manuf. of pigmented lacquers although some org. lakes and toners that are non-bleeding in oil varnishes will bleed in lacquers. F. A. W.

Tricresylphosphate as a lacquer plasticizer. M. R. TRIMMER. *Paint, Oil and Chem. Rev.* **80**, No. 10, 10(1925).—Tricresylphosphate is odorless, colorless, neutral, non-volatile, and non-inflammable; $d_{15} 1.176$. It is slightly less viscous than glycerol and is miscible in all proportions with the common org. solvents. When added to lacquers it imparts toughness, flexibility, gloss and flowing properties. On heating at 45° for 50 days, practically no evapn. takes place. Pigmented lacquers can conveniently be made by grinding the pigments in tricresylphosphate, and then stirring the paste into the clear lacquers. F. A. WERTZ

Aviation dopes or varnishes. MAURICE DESCHIENS. *Chemistry & Industry* **44**, 902-7(1925).—A review of the history of airplane dopes, of the manuf. of cellulose acetate, the methods of dissolving it in solvents, application of the dope to the wing fabric, etc., with typical formulas. F. A. WERTZ

Physiological effects of vapors from a few solvents used in paints, varnishes and lacquers. H. A. GARDNER. *Paint Manufs. Assoc. of U. S., Circ. No. 250*, 89-149 (1925).—Tests were made on rabbits of the effect of the vapors of 6 grades of turpentine, including pure gum spirits and a number of grades of wood turpentine of various degrees of refinement, of mineral spirits, C_6H_6 , solvent naphtha, butanol, furfural and dipentene. Blood charts, clinical reports, autopsy and pathol. reports are given in detail. C_6H_6 is the only one of these solvents which has a marked deleterious effect upon the animals, producing definite symptoms of poisoning and death. The higher homologs of C_6H_6 appear to be much less poisonous, and solvent naphtha, 160° , showed no deleterious effects except slight mucuous membrane irritation. Vapors of mineral spirits, gum spirits turpentine, or highly refined steam-distd. wood turpentine are non-toxic. The vapors of lacquers contg. Am acetate, Bu acetate, toluene, alc., or furfural are not dangerous where ordinary ventilation exists. F. A. WERTZ

Old and new about colophony. A. SAMTLEBEN. *Farben-Ztg.* **30**, 2863-5(1925).—A brief review is given of the variously ascribed constitutional formulas for abietic acid. Since rosin appears to belong to a terpene group, and the fossil resins may have originally consisted of closely related substances that have been transformed by time, attempts were made to bring about the polymerization of rosin and its glycerol ester by long heating, with and without the use of catalysts and pressure. Most of these attempts gave no results, but a certain org. acid catalyst produced a product resistant to acids and alkalis, m. 84° , that produced an excellent varnish. S. believes that research in this direction might lead to a method for the "copolisation" of rosin. F. A. W.

Properties of Malayan damars. T. H. BARRY. *J. Oil and Colour Chemists' Assoc.* **8**, 125-6, 204-6(1925).—A general description of the origin and nature of various varieties of Malayan damars is given, and their m. p., acid no., insol. matter in $CHCl_3$, and ash are tabulated. Cf. *C. A.* **19**, 408. F. A. WERTZ

Lead resinate solutions. I. CH. COFFIGNIER. *Bull. soc. chim.* **37**, 1078-85 (1925); cf. Nicolardot and C., *C. A.* **14**, 1449.—Solns. were prepd. contg. 5-25% of Pb resinate (contg. 5 and 10% PbO) in C_6H_6 , spirits of turpentine and white spirit (d 0.780). Periodical detns. were made of the viscosity, ppt. and ash in the ppt. The results (given in detail) show that the resinate contg. 5% PbO gives C_6H_6 solns. which are stable for at least 2 months, spirits of turpentine solns. in which the pptn. is slight while the increase in viscosity with time is greater the stronger the soln., and white spirit solns. from which the resin ppts. out at an irregular rate even after 6 months. The resinate contg. 10% PbO behaves in a very similar manner, but the ppts. from the C_6H_6 and white spirit solns. were greater than those with the 5% PbO resinate. The spirit of turpentine solns. give practically no ppt. in 2 months, but the increase in viscosity is considerably higher than that with the 5% PbO resinate, and there is appreciable swelling of the granules in the 25% soln. The pptn. of resins is attributed to a reaction represented by $2(RCO_2)_2Pb - RCO_2H \longrightarrow (RCO_2)_2Pb(m - n)RCO_2H +$ pptd. resins sol. resins

A. PAPINEAU-COUTURE

Some problems of the paint and rubber industries (PORRITT) 30. Anaconda electrolytic white lead (BOWMAN) 4. Reducing the viscosity of nitrocellulose solutions for use as a varnish or lacquer] (U. S. pat. 1,553,494) 23. C pigment (U. S. pat. 1,552,473) 23.

"Copper paint." R. G. GIANELLI. U. S. 1,555,198, Sept. 29. A solid compn. adapted for liquefaction by heating for coating hulls of ships, etc. comprises tallow 8, powd. C 2, powd. "bluestone" 2 and Pb_2O_4 2 parts.

Water-paints. F. SCHWARTZ and E. GIL-CAMPORRO. Brit. 231,457, March 26, 1924. A H_2O -paint or varnish is obtained by saponifying gums or resins in the presence of NH_4 resinat and mixing the soap obtained with an oil saponified with NH_4 and an aq. soln. of casein, albumin, ceratin or similar substance.

Paint or printer's ink solvent. J. E. RHODES. U. S. 1,553,914, Sept. 15. A mixt. of kerosene 28 satd. with rosin, varnish 1 and a double silicate of Mg and Ni 1 part is used for thinning printer's ink, etc.

Bituminous paints. P. LECHLER. Brit. 231,411, April 25, 1924. Coal-tar pitch, chlorobenzene and C_2H_5Cl may be used with raw cresols and naphtha, with addn. of soaps of Cu or Hg (which may be formed in the paint mixt.) if anti-fouling paints are desired.

Carbon pigment. D. J. OGILVY. U. S. 1,550,042, Aug. 18. A carbonaceous flame (which may be produced by the combustion of gas, oil, pitch or resin) is impinged against a wet surface of a revolving cylinder.

Pigments. L. A. SANDERS and K. A. ROTH. Brit. 230,883, Nov. 9, 1923. Pigments (or colored powders which are converted into pigments by calcination) are produced by pptg. inorg. colored substances from an aq. soln. upon a large excess of a finely divided inorg. carrier such as chalk, cement; ground shells, soapstone, gypsum, infusorial earth, trass, kaolin, marl, feldspar, hornblende, asbestos, loam, fluorspar, lime, waste marble, pumice, mica or dolomite. Org. substances such as alizarin may be added as may also $Al(OH)_3$ or casein.

Basic lead sulfate pigment. J. A. SCHAEFFER, J. H. CALBECK and B. S. WHITE. U. S. 1,555,520, Sept. 29. Pb ores and similar materials contg. S are treated in low cupola furnaces for the production of a basic Pb sulfate fume, and gas and fume thus formed are drawn through a system of hot flues and cooling devices. Atomized Pb is simultaneously sprayed into a heated furnace chamber contg. O and SO_2 to produce a basic Pb sulfate fume. The fumes and gases from the 2 furnaces are mixed and the fume is sepd. by screening. Cf. C. A. 19, 1060.

Paint-removing composition. W. J. TENNIS. U. S. 1,553,485, Sept. 15. Denatured alc. 2 qts., C_2H_5 3.75 pints, H_2SO_4 $1/4$ pint, paraffin $1/4$ oz. and soap 3 oz.

Sympathetic ink. A. ROGERS. U. S. 1,553,556, Sept. 15. See Can. 246,943 (C. A. 19, 1353).

Doped airplane fabric. A. F. SULZER. U. S. 1,552,808, Sept. 8. Airplane fabric is doped and rendered taut with a coating contg. H_2O -insol. ethyl cellulose which is highly resistant to becoming brittle at low temps. A layer applied directly to the fabric contains substantially no plastifiers and successive layers applied over it contain plastifiers such as triphenyl phosphate and camphor.

Varnish-removing composition. A. SHETZLEY. U. S. 1,553,724, Sept. 15. Na percarbonate 98, and Na peroxide $1 1/2$ parts are dissolved in boiling H_2O .

Synthetic resins. A. DANILOWITSCH and G. PETROFF. Brit. 231,501, March 25, 1924. In the condensation of phenol with formaldehyde or formaldehyde-producing substances, naphthalene- α -sulfonic acid is used as a catalyst, with glycerol and fusel oil to retard hardening, the product is dehydrated *in vacuo* and then hardened by heating it in molds to obtain a transparent infusible product.

Resinous phenol-aldehyde condensation products. CANADIAN ELECTRO PRODUCTS CO., LTD. Brit. 232,277, Oct. 18, 1923. $PhOH$, cresol or naphthol is caused to react with C_6H_5 in the presence of H_2SO_4 and Hg sulfate or other catalyst and the product is further treated with an aldehyde, e. g., AcH , CH_2O or its polymers or furfuraldehyde. Amino compds. or paraformaldehyde may be used as hardening agents.

Rosin composition. H. S. MILLS. U. S. 1,556,237, Oct. 6. A mixt. adapted for rosinning violin bows is formed by blending rosin with gum sandarac in a volatile solvent such as alc., using sufficient rosin to constitute at least 80% of the product.

Lac. T. W. BARBER. Brit. 231,621, Feb. 8, 1924. White or bleached lac is pressed into thin sheets, strips or threads to eliminate its content of acidulated H_2O and produce a readily sol. product which does not easily deteriorate.

Lithopone. FARBENFABRIKEN VORM. F. BAYER & Co. Brit. 225,523, Nov. 30,

1923. To render lithopone fast to light, it is associated with 0.02–0.5% of heavy metal compds. such as those of Fe, Co, Ni and Cu.

Vertical tubular retort for lithopone treatment in muffle furnaces. W. R. MACKLIND, G. C. MCCARTEN, W. S. STEVENS, E. C. HOLTON and H. J. HAIN. U. S. 1,550,271, Aug. 18.

Coating wood, metal, leather, etc., with "Zellon." R. OCHSCHIM. Brit. 231,129, March 22, 1924. Heat, pressure and a cementing soln. of "zellon" (a non-inflammable celluloid-like material) are used to unite "zellon" sheets to other materials.

Compositions for making printers' blankets. A. F. DECKER. Brit. 231,964, Jan. 22, 1924. A layer of rubber or cork compn. is covered with fabric facings at least one of which is wool. Formulas are given of cork and rubber mixts. and of nitrocellulose compns. suitable for use as ink-repellent coating material. Cf. C. A. 19, 2138.

Printing surfaces. E. FABIAN. U. S. 1,549,859, Aug. 18. A metal foundation such as an Al or silvered Cu plate is treated with HCl, HNO₃ or other acid reagent capable of transforming the surface portion of the plate into a metallic salt, an original design is applied with an ink contg. NH₃ or other alk. pptg. agent, to ppt. another metal compd. from the metal salt on the plate. The foundation is then inked for printing, with an ink having a fatty base. U. S. 1,549,860 specifies treating foundation plates with an acid soln. of a metal salt which may contain Al(NO₃)₃ and chlorides of Mg and Fe.

27—FATS, FATTY OILS, WAXES AND SOAPS

E. SCHERUBEL

Fat cleavage by means of zinc and the purification of the resulting glycerol. J. KRAUSE. *Z. deut. Oel-Fett-Ind.* 45, 527–9(1925).—Fat cleavage by means of ZnO yields fatty acids of good color; inferior grades of fat yield acids the color of the original fat, but are lighter if metallic Zn powder is used simultaneously with ZnO. To obtain high % of cleavage it is essential to work with purified oils, avoid permanent emulsions, use clean ZnO and pure H₂O; chem. softened H₂O often contains free alkali which forms soaps in the autoclave. The glycerol liquor is purified with milk of lime, filtered, acidified with H₂SO₄, neutralized with Ca(OH)₂ and again filtered. P. ESCHER

The hardening of fats. V. SCHWARZKOPF. *Z. kompr. u. flüssige Gase* 24, 32–5 (1925).—Brief review of the technical features of this industry. R. L. DODGE

The determination of moisture in fats and oils. W. NORMANN. *Z. angew. Chem.* 38, 592–3(1925); cf. C. A. 19, 2277.—A discussion of the methods of other workers. E. SCHERUBEL

Pressing or extracting. K. LÖFFL. *Seifensieder Ztg.* 52, 733–4(1925).—Decision whether pressing or extg. is desirable must be made for each oil separately. Table oils with a specific aroma or flavor require cold pressing. Oils that are to be worked up into edible fats, and the various technical oils call for extn., for economic reasons. It is essential to remove all traces of the solvent from the residual press cakes if used as animal fodder. P. ESCHER

Extraction of the highly unsaturated fatty acids from fish oils. YOSHIYUKI TOYAMA and TOMOTARO TSUCHIYA. *Chem. Umschau Fette, Oele, Wachse u. Harze* 32, 204–7(1925).—In order to isolate the most highly unsatd. acids from fish oils T. and T. employed 3 methods: (1) The method based on the insolubility of Na soaps in acetone contg. H₂O. (2) In acetone contg. alc. (3) In acetone contg. H₂O and alc. The 1 no. of the isolated acids in all cases is higher the less H₂O or alc. is present in the acetone. T. and T. recommend method 3 as the most useful, because the sepd. acids have less tendency to form a sticky mass difficult to break up. All 3 methods are only qual. seps., but it is possible to obtain by their means concd. portions of highly unsatd. fatty acids. The constns. of the fatty acids of the original oils are given in 3 tables. P. ESCHER

The constitution of tetradecylenic acid from sperm oil. MITSUMARU TSUJIMOTO. *Chem. Umschau Fette, Oele, Wachse u. Harze* 32, 202–4(1925).—The preliminary formula CH₃(CH₂)₇CH:CH(CH₂)₅COOH which T. gave for tetradecylenic acid (C. A. 17, 3618) is confirmed through the isolation of glutaric acid from the products of oxidation by Harries' ozone method. The acid was obtained from the lower fatty acids of sperm oil by means of the Pb salt-petroleum ether method, and was treated in cooled CHCl₃ soln. with O₃, contg. 9–12% O₃, yielding the ozonide peroxide, C₁₄H₂₆O₆, d₁₅ 1.063 and n_D₂₀ 1.4645. This peroxide was decompd. by hot H₂O, the oily top layer extd. with ether, the ether soln. shaken with NaHCO₃ and the resulting products were purified and

analyzed. From the ether soln. were isolated nonyl aldehyde and pelargonic acid (4.7 g.) and from the bicarbonate product as well as from the H_2O soln. were isolated glutaric acid and the half aldehyde of glutaric acid (?) (4.0 g.), a total yield of 8.7 g. from 15 g. ozonide peroxide, small but sufficient to fix the position of the double C bond in tetra-cyclyenic acid.

P. ESCHER

Constituents of the marking nut: *Semecarpus anacardium* Linn. D. SATYANARAYANA NAIDU. *J. Indian Inst. Sci.* **8A**, 129-41(1925).—Examn. of the products obtained by successive extrn. with light petroleum, alc. and H_2O resulted in the isolation of a fixed oil from the kernels, catechol (0.1% on the wt. of the nuts), *anacardol*, $C_{18}H_{30}O$ (new), an acid $C_{17}H_{16}O_6$ yielding an insol. Ba salt, an acid $C_{18}H_{14}O_6$ yielding a sol. Ba salt, and the K salt of an acid with strong reducing properties which has not yet been isolated. The fixed oil from the kernels resembles cashew-kernel oil and had d_{15}^{25} 0.9277, n_D^{60} 1.4574, acid value 23.9, sapon. value 216.5, I value 101.4; and the fatty acids of the oil had Hehner value 87.5, n_D^{60} 1.4473, titer test 12.2, mean mol. wt. 293, satd. acids 13.3%, m. p. of satd. acids 51.1–51.5°, unsaponifiable 0.82% (of which 30% is a sterol). *Anacardol* is a mobile, pale yellow oil when freshly distd., turning brown and then black on exposure to the atm., with strong corrosive action on the skin, d_{15}^{25} 0.9693, n_D^{25} 1.5078, C 82.7%, H 11.3%, O 6.0%, mol. wt. (via Fawsitt, *C. A.* **14**, 242) 275, OH (via Hibbert and Sudborough, *J. Chem. Soc.* **85**, 933(1904)) 6.26. Br in CCl_4 soln. substitutes for 3 H atoms, but forms no additive compd. The oil is sol. in all org. solvents, including petr. ether, insol. in H_2O , NH_3 and Na_2CO_3 , and sol. in KOH and NaOH solns. with darkening; the alc. soln. darkens rapidly, with $FeCl_3$ gives a dark green coloration and finally a dark colored ppt., gives ppts. with salts of Ba, Al, Pb, and Zn all of which tend to turn dark-green and liberate dark oily products when acidified; the soln. in anhyd. Et_2O or C_7H_8 evolves H in the presence of Na. Acetylation gives a mobile non-corrosive oil, n_D^{26} 1.4875. Benzoylation in C_6H_5N soln. gives a yellow, viscous Bz deriv., which on keeping deposits BzOH. No definite compds. could be isolated from the products of oxidation with Br, HNO_3 - H_2SO_4 , CrO_3 or $KMnO_4$. Distn. with Zn dust and subsequent rectification at 12 mm. gave an oil b. 110–20° (mainly 115°) at 12 mm., n_D^{28} 1.4918, C 87.7%, H 10.75%. White *anacardol* picrate, m. 100–1°, was prepd. The acid $C_{17}H_{16}O_6$ dissolves in alkalis to a yellowish or orange-red and is repptd. by passing CO_2 ; in alc. soln. it gives a violet coloration with $FeCl_3$; in NH_3 soln. it reduces $AgNO_3$ when gently warmed and is readily attacked by $KMnO_4$; it forms insol. Ca, Ba, Cu, Pb and Ag salts (the Ag salt readily decomposes); on being fused with phthalic anhydride and made alk. it gives a carmine-red phthalcin deriv.; it couples with $PhNH_2$ or sulfanilic acid; and possesses most of the characteristics of a phenolic acid. With Ac_2O and $AcONa$ it gives an almost colorless powder, m. 126–7°, corresponding with none of the Ac derivs. of the acid; with $BzCl$ and alkali it gives colorless crystals, m. 142–3°; nitration gives a product m. 110–2°; bromination gives $C_{17}H_{11}Br_6O_6$, m. 160–1°; with Me_2SO_4 in presence of 40% KOH it gives a neutral substance (probably an ether-ester) m. 120–1° and an acid (probably an ether-acid) m. 161–3°. The ordinary reagents of the ketone group did not give definite products. The soly. and reactions of the acid $C_{18}H_{14}O_6$ are very similar. In alc. soln. it gives a reddish brown coloration with $FeCl_3$.

A. PAPINEAU-COUTURE

Argemone oil. S. N. IYER, J. J. SUDBOROUGH AND P. R. AYYAR. *J. Indian Inst. Sci.* **8A**, 29–38(1925).—Extn. of the crushed seed of *Argemone mexicana* L., with petr. ether gave 29.4% of a yellow oil with d_{20} 0.9209, n_D^{60} 1.4601, sapon. no. 190, I no. 121, Ac no. 39, acid value 12.0, Reichert-Meissl no. 0.3, Polenske no. 0.2, unsaponifiable matter 1.3%, Hehner no. 93.0. The curve showing the relation between n and I nos. of hydrogenated samples of oil is characteristic and resembles that for the rape oils. This is due not to the presence of acids of high mol. wt. such as behenic, lignoceric, or erucic, but to a certain quantity of hydroxy acids. The values given show that more than one-third of the total OH is present in the unsatd. acyl groups and the remainder in the alkyl group, presumably as diglyceride, and that the acyl OH undergoes complete reduction and the alkyl OH partial reduction during hydrogenation. The mixed acids consist of palmitic 7.95, stearic 5.95, palmitoleic 5.87, oleic 21.79, linolic 48.02, linolenic 0.58, ricinoleic 9.84%. The unsapon. contained 35% *sitosterol*.

Deodorization of fish oil and fish-oil soap. F. R. TAPPERT. *Z. deut. Oel-Fett-Ind.* **45**, 446–8(1925); illus.—The app. and process for deodorizing fish oils and fish-oil soaps are described: the oil is heated to 280–300° for 2–3 hrs. under a slight vacuum and later is treated at 50–60° with $1/2$ –1% of 66° H_2SO_4 to remove albuminous and mucilaginous matter. The fish-oil soap is deodorized at the same temp. but under a pressure of 40 atm.

P. ESCHER

Idrapidspalter. M. GELBKE. *Chem. Umschau* **32**, 213-20(1925); cf. *C. A.* **19**, 2753, 3028 and following abstr.—Analysis of an Idrapidspalter showed 81.6% effective sulfonic acid, 5.8% unsapon., 1.9% free H_2SO_4 and 10.6% H_2O . The concd. product varied between 10 and 15% ether-insol., 85-90% ether-sol., 5-10% H_2O , 2-7% H_2SO_4 , 6-11% unsapon. (aromatic hydrocarbons) and 75-80% fat-splitting aromatic sulfonic acids. These sulfonic acids can be sepd. into 20-25% cryst. aromatic acids and 60% high mol. polymerized, liquid, red-brown sulfonic acids of unknown constitution, but highly active, the true cleavage agents. Comparative expts. for splitting effects of other Twitchell reagents lead G. to the following conclusions: Idrapidspalter, when freed from its accompanying free H_2SO_4 , possesses an activity which is ineffective for industrial use; the satisfactory effectiveness of Idrapidspalter resides in its free H_2SO_4 , introduced during manuf. Its activity is below that of the "Kontakt-spalter" under like conditions. Treatment of the Idrapidspalter with ether does not cause any mol rearrangement but simply removes some 20% ballast which contains no sulfonic acids.

P. ESCHER

Idrapidspalter. SCHRAUTH. *Z. deut. Oel-Fett-Ind.* **45**, 493-4(1925).—An answer to Gelbke's article (*C. A.* **19**, 2753) in which he claims that Schrauth's Idrapidspalter is less active than the standard product. Cf. preceding abstr.

P. ESCHER

• **Emulsifying power of various soaps.** J. AUGUSTIN. *Seifensieder Ztg.* **52**, 731-2 (1925).—A brief review of the principles of forming emulsions by means of soaps, principally Na and K soaps.

P. ESCHER

Splitting fats in autoclave practice. C. SCHULZ. *Chem. Umschau* **32**, 186-8 (1925).—An account of obtaining 93-98% splitting effects by dividing the process into a preliminary autoclaving of 4 hrs. to an 80-85% split and 2nd final split of 3 hrs. using an acid treatment and a wash between the 2 operations.

P. ESCHER

Catalysts for saponification of fats and their special uses. A. BEYER. *Trib.* **3**, 903-9(1925).—Brief review of the manuf. and use of Twitchell's reagent, Paal's "Pfeilringspalter" and Petroff's "T contact."

A. PAPINEAU-COUTURE

Stratification in settled soaps. W. HEIM. *Z. deut. Oel-Fett-Ind.* **45**, 429-30 (1925).—A tendency exists for settled soaps in their top layer to be richer in fatty acids by as much as 4.18% than the lower layer, due to a lower H_2O content; foreign salts are slightly higher toward the bottom layers.

P. ESCHER

A new method for the manufacture of cheap transparent soap. H. KASARNOWSKI. *Z. deut. Oel-Fett-Ind.* **45**, 445-6(1925).—K. adds to settled or cold-made soaps 30 to 50% of "diaphan-oil," a mixt. of methylhexalin and Na oleate, obtaining a transparent soap which after several days is of good consistency. This method is also applicable to laundry soaps. Cf. *C. A.* **19**, 2421.

P. ESCHER

Modern manufacture of candles and wax-goods. A. LÖDL. *Seifensieder Ztg.* **52**, 544-7, 567-70, 589-90, 606, 624-5(1925); illust.—A general review under the following captions. I. Candles; raw materials. II. Beeswax bleaching. III. Technical wax goods.

P. ESCHER

Protective action of soaps (BHATNAGAR, *et al.*) 2. Soaps and the theory of colloids (MCBAIN) 2. Stationary extraction plants (HASSEL) 13. Converting oils (Brit. pat. 231,157) 22. Distilling fatty acids (Brit. pat. 231,686) 13. Apparatus for separating water and impurities from soaps, fats, etc. (U. S. pat. 1,555,231) 4.

Thickening fatty oils. W. CALDERWOOD, A. E. WEBB and C. A. REIHL. Brit. 217,150, Dec. 31, 1923 and U. S. 1,514,432, Nov. 4, 1924. Oils are thickened without oxidation by heating and cooling in a filled hermetically sealed vessel connected through a sealing trap with supply and expansion vessels.

Purifying fats and oils. H. BOLLMANN. Brit. 231,126, March 24, 1924. Fats and oils are decolorized by mixing with Al silicate or other decolorizing powder and passing the mixt. through a tube provided with agitators and then immediately through a centrifuge to sep. the powder.

Refining cotton oils. D. MCNICOLL. Brit. 232,361, Feb. 6, 1924. Cotton oils and the fatty acids obtained as by-products in refining the oils are decolorized by treatment with Na decaborate and NaCl or with other prepn. in aq. soln. of a metal borate which is acid to phenolphthalein in aq. soln. The purified oils may be further refined with NaOH. The coloring substance obtained, gossypol, may be used as a substitute for logwood, cutch, fustic, etc.

Purifying fats and fatty oils. H. BOLLMANN. Brit. 231,791, Sept. 3, 1924. Oils or fats are repeatedly atomized with superheated steam as they are passed downwardly through a column still connected with a vacuum pump for withdrawal of vapors.

Extracting fatty oils from seeds, etc. G. KAMMERMANN. Brit. 231,296, Feb. 22, 1924. Expression of oil from seeds, etc., is facilitated by a preliminary vacuum treatment followed by addn. of moisture at least to replace that removed. Cf. C. A. 18, 338.

Olive oil. S. HILLER. U. S. 1,553,162, Sept. 8. The constituents of olive meats are reduced to a state of colloidal suspension in an emulsion of the oil and H_2O which they contain, and the suspended solids, oil and H_2O are then sepd. from each other, c. g., by centrifuging.

Soap powders containing oxygen. R. KORSALT. U. S. 1,555,588, Sept. 29. Finely pulverized $KMnO_4$ is mixed with paste-like neutral soap, calcined Na_2CO_3 is added to form a dry granular product and this is mixed with a perborate.

28—SUGAR, STARCH AND GUMS

F. W. ZERBAN

The use of Norit in Czechoslovakian sugar factories. BERTHOLD BLOCK. *Centr. Zuckerind.* 33, 781-3, 818-21 (1925).—Detailed flow sheets of the use of Norit in the refinery at Ratbor, in refining at Klittenberg, and in working beets at the latter factory. Too detailed to abstract

W. L. BADGER

The origin of the Dutch sugar standards. W. M. F. MANSVELT. *Planter and Sugar Mfr.* 75, 148-9 (1925).—The Netherlands Trading Soc. in 1839 found a broker submitting samples which were not representative of the lot. To avoid the recurrence of this, a set of samples grading from the very darkest to white sugar was made up. The original no. of 21 was later reduced to 18. These have been revised as the quality of the sugar produced has been improved till they now number from 8 to 25. Their use has permitted closer grading. Samples are now issued by the Society annually and in many countries still serve as the basis of classification. Polarization is the U. S. basis of evaluation but the color classification is also considered. C. H. CHRISTMAN

Indicators in the sugar laboratory. H. A. COOK. *Sugar* 27, 117-8, 172-4 (1925); cf. C. A. 19, 2755.—Lack of definiteness in the expression of acidity and alk. in the sugar labs. has been prominent. Studies in clarification and the keeping qualities of juice have shown the importance of considering the degree of acidity, or p_H , rather than total acidity or alk. as formerly expressed. With inversion in clarified juices occurring at more alk. p_H ranges not formerly appreciated, a definite expression of acidity is necessary to locate this danger zone. The use of litmus is not recommended because of its broad p_H range and lack of sensitiveness. The indicators suggested by Clark are suitable for sugar work. The spot test method for detg. p_H is used. A color chart on celluloid is being prepd. for factory control. C. H. CHRISTMAN

Color comparator for hydrogen-ion concentration. G. P. MEADE and R. BAUS. *Planter and Sugar Mfr.* 74, 509 (1925).—A sliding tube rack encased in a thin metal cover is fitted with permanent colorimetric standards, the tubes being alternated with tubes of distd. H_2O . In front of the sliding rack and before suitable apertures in the cover are sockets for removable tubes. A ground-glass back is located on the opposite side. For refinery liquors, bromothymol blue is used. Five cc. liquor is dild. with 15 cc. water and 10 cc. transferred to each of the tubes, 0.5 cc. indicator added to one tube and the comparison made with the standards. C. H. CHRISTMAN

Influence of changes in alkalinity on changes in color of sugar solutions. HARALD LUNDÉN. *Centr. Zuckerind.* 33, 1013 (1925).—Changing the p_H of a soln. of molasses or 2nd raw sugar from 10 to 1 caused a lowering of color by 13-18% of the color at $p_H = 10$. A sugar prepd. from affination liquor has its color decreased 60% by the same change. Cane products are more sensitive; if the color of affined sugar at $p_H = 10$ is 1.00, at $p_H = 2.0$ it is only 0.14. After-products show a little less change. The curves of color vs. p_H show a point of inflection like an electrometric titration. It is assumed that there are 2 colored substances present—one, an "old" substance present mainly in after-products, not sensible to p_H ; the other, the "new" color, possibly formed by the action of alkali on sucrose, is an indicator. Its neutral point is $p_H = 5.10$ for beet products and 7.0 for cane, hence it is possible that beet and cane sugars owe their colors to different substances. The "new" color gradually passes over into the "old." W. L. BADGER

A new and most valuable clarification process for the sugar industry. W. D. STEPHENSON. *Planter and Sugar Mfr.* 74, 353 (1925).—Lime as the sucrate is added to the raw juice in a coagulator. The rate is adjusted to produce the max. pptn. of impurities through the neutralization of the natural acidity. The sirup is held at the

optimum p_{H_2} , and with uniform maintenance the excessive action of lime on glucose is avoided. Large flocs are developed, settle rapidly and the juice is brilliant. Fouling of the heating surfaces is avoided. C. H. CHRISTMAN

The refining qualities of raw sugar as influenced by clarification and boiling methods in the sugar factory. T. B. WAYNE. *Planter and Sugar Mfr.* **75**, 128-9(1925).—Ash in raw sugar is detd. as a matter of routine. No est. can be made of its melassigenic action. Spectrophotometric analyses have shown that sugars of certain colors have superior refining qualities. Uniform crystal size is desired to permit proper affination. Mixed grain in sugars denotes poor purging in the raw-sugar factory, with a greater amt. of impurities in the sirup film. Filtrability of raw sugars is a function of the colloidal matter present and closely correlated to the completeness of the original clarification. C. H. CHRISTMAN

Sugar-refinery mother liquor. E. SAILLARD. *Planter and Sugar Mfr.* **75**, 68-9(1925).—The exhausted molasses from the Ba process was examd. for sucrose. Analyses of the molasses before and after fermentation were made. The Clerget method gave low sucrose results. As reducing sugars were absent in the original molasses, and produced by acid inversion, S. corrects the neutral double polarization by subtracting from the Clerget readings the content of hydrated raffinose, and secures a true sucrose content. C. H. CHRISTMAN

Determination of the density and hardness of refined sugar. K. J. SMOLENSKI. *Gazeta Cukrownicza* **1924**, 19-22; *Centr. Zuckerind.* **33**, 857-8(1925).—A lump of the sugar is weighed, then satd. with a light petroleum oil, and its vol. detd. in a voluminometer filled with the same oil. This gives apparent d ; % pore space can be detd. by weighing with and without the oil. True d_s are about 1.56, pore spaces 13-20%. apparent d . 1.14-1.31. W. L. BADGER

Catalysis in the sugar industry. E. SAILLARD. *Planter and Sugar Mfr.* **74**, 269(1925).—In sirups, oxidation of H_2SO_3 and sulfites is very slow. Pptn. of CaO by H_2SO_3 is retarded in sirups and is not complete after 24 hrs., even when present in equiv. aunts. Pptn. by Na_2CO_3 is not complete but is greater than with the acid. Heat, agitation and kieselguhr accelerate the pptn. Incompleted pptns. such as these have a direct bearing upon the incrustation of evap. surfaces. C. H. CHRISTMAN

The application of high-pressure steam to power generation in the sugar industry. P. LIMPRECHT. *Centr. Zuckerind.* **33**, 739-43, 780-81(1925).—A lecture discussing the generation of steam at pressures up to 1000 lbs., its use in power generation, and its effect on the heat balance of a sugar mill. Pressures over 40 atm (600 lbs.) are not desirable until the demand for heat is larger in proportion to the demand for power than at present. W. L. BADGER

High-efficiency turbines and their effect on boiler pressures in the electrification of sugar factories, especially considering possible changes in evaporation. W. HEUCKE. *Centr. Zuckerind.* **33**, 621-3(1925).—If a general electrification is planned, the turbine of highest efficiency should be selected, and boiler pressures of 300-350 lbs. chosen. This makes possible a change of existing evaporators to pressure evapn. with the min. expense. W. L. BADGER

A contribution to the theory of evaporation with special reference to sugar-factory operation. BOHUMIR PRACEK. *Z. Zuckerind. Cechoslov. Rep.* **49**, 315-21, 323 S(1925); *Listy Cukrovarnické* **43**, 41ff(1924-5); cf. *C. A.* **18**, 3122.—Mathematical. W. L. BADGER

Present methods of preparing thick juice. G. BARTSCH. *Deut. Zuckerind.* **50**, 747-51(1925).—A review, with many references, of recent articles on diffusion, carbonation, filtration and sulfitation. W. L. BADGER

The significance and economy of filtration of thick juice with activated carbon. V. SÁZAVSKÝ. *Z. Zuckerind. Cechoslov. Rep.* **49**, 487-9(1925).—A lecture. The savings are considerable. W. L. BADGER

Raw-juice heating by vapor injection in the Frisia (Holland) sugar factory. KROON. *Centr. Zuckerind.* **33**, 779(1925).—Juice from the measuring tanks is pumped through an ordinary heater operating on vapors from the 4th effect. It is then drawn by vacuum to an elevated jet condenser, where it is heated by vapors from the 3rd effect. From the fall pipe of this condenser it passes to another where it is heated to 94° by vapors from the 2nd effect. It then goes to the carbonation station. The increased evapn. caused by diln. is estd. as 12.6%. Diln. of the juice results in better color and better heat transfer in the evaporators, so additional surface is not needed. The evaporator condenser takes less water. W. L. BADGER

The composition of juices in the campaign of 1924-5. JIRI VONDRAK. *Z. Zuckerind. Cechoslov. Rep.* **49**, 355-62(1925).—The av. figures were detd. from the reports of

23 factories. Diffusion juice: 17.26° Bx., 15.78 polarization, 91.5 purity, 0.10% invert; thick juice: 61.11° Bx., 58.15 polarization, 95.2 purity, 0.042 alky., 0.017 CaO, color 11.2° St. Calcd. to 100 parts sugar, the results for (a) diffusion juice, (b) thick juice and (c) % of material in diffusion juice removed by carbonation, are: Non-sugars, (a) 9.5, (b) 5.1, (c) 46; total N, (a) 0.442, (b) 0.300, (c) 32; albuminoid N, (a) 0.102, (b) 0.002, (c) 98; ammoniacal N, (a) 0.024, (b) 0.003, (c) 92; amido N, (a) 0.034, (b) 0.006, (c) 82; betaine N, (a) 0.124, (b) 0.123, (c) 1.0; harmful N, (a) 0.299, (b) 0.292, (c) 2.0.

W. L. BADGER

The normal juice factor: its possibilities as a basic control factor in the chemical control of cane sugar factories. A. H. WARREN. *Planter and Sugar Mfr.* 74, 369-70, 390-1(1925).—See C. A. 19, 2140.

C. H. CHRISTMAN

Comparative values of normal juice factors. R. ELLIOTT. *Planter and Sugar Mfr.* 74, 449-50(1925).—Data for the calcn. of normal juice factors are shown and it is concluded that, because of different operating conditions, the comparison of factories on the basis of their normal juice factors is useless. Comparable data between factories using flume cane and those which weigh their cane cannot be secured. The Java ratio serves better in this comparison.

C. H. CHRISTMAN

Viscosity tests for sugar solutions. *HAWAIIAN SUGAR PLANTERS' ASSOCIATION. *Sugar* 27, 168-70(1925).—In the refinery all filtered sugars will refilter at the same rate, and original differences in the rate of filtration are due to the insolubles in the original sugars. Sepn. of the insolubles in sugars by passing through linen removes coarse suspended matter. Centrifuging separates out a very fine non-settling matter and the rate of filtration is very closely related to the amt. of this material in a sugar. Poor clarification gives a larger amt. of the material. Liming to the optimum point, with the use of H_3PO_4 in juices deficient in P_2O_5 , improves clarification. Cane wax is a part of the non-settling matter, but not as large a proportion as was indicated in the 1923 report. Optimum clarification produces large vols. of settlings. Oftentimes the lack of adequate filtering and settling capacity requires operation not approximating the optimum. The filtrability of Hawaiian sugars averaged 65.3 in 1922, 72.3 in 1923 and 80.6 in 1924 without increase in polarization, largely because of improved clarification.

C. H. CHRISTMAN

Cause of coloration of juices on evaporation. OTTO PANKRATH. *Centr. Zuckerind.* 33, 619-21(1925).—Criticism minor details of the work of Tschaskalik (C. A. 19, 3333).

W. L. BADGER

The pan station and its steam consumption. ALPH. HEINZE. *Deut. Zuckerind.* 50, 705-8(1925).—The discussion is based on the use of steam at 104-106° from the 2nd or 3d effect of the evaporators during the first stages of boiling, and at 110-115° from the 1st or 2nd effect during the rest of the cook. The effect of the consequent irregular demands on the evaporators is irregular operation, not only in the evaporator station, but all through the mill. It is recommended that for white pans there be not less than 3, of equal size and construction, taking about 9 hrs. per charge, with charges following at regular intervals. Lower-pressure steam should be used in one pan only until the next one comes on. The evaporators must be designed with these fluctuations in mind.

W. L. BADGER

Utilization of ammonia from the ripening of after-product fillmass. EDUARD VIEWEGH AND JAROSLAV HRUDA. *Z. Zuckerind. Cechoslov. Rep.* 49, 331-5, 339-43, 347-53(1925).—Fillmass was ripened in an exptl. crystallizer 900 mm. long, 450 mm. in diam., an exact copy of the Bock crystallizer. The NH_3 evolved was detd. at 12-hr. intervals. The total NH_3 recovered in 144 hrs. in 3 expts., was from 0.0006 to 0.0017 g. per 100 g. fillmass, corresponding to 0.04-0.09% of the total N in the fillmass. W. L. B.

The influence of caramel on the velocity of the crystallization of sucrose. J. A. KUCHARENKO AND Z. B. ROZOVSKY. *Planter and Sugar Mfr.* 75, 130(1925).—The presence of caramel retards the velocity of crystn. of sucrose in proportion to its concn. in solns. of different degrees of supersatn.; equal amts. of caramel exhibit a greater retarding effect in the more concd. solns.

C. H. CHRISTMAN

Petree process at Puunene. W. LOUGHER. *Planter and Sugar Mfr.* 75, 268-9(1925).—Greater recoveries of sucrose were made while the Petree process was operated. The extn. was lower however. Excess bagasse was accumulated because of heat conservation made possible by clean juice. The juice after passing the Peck strainer is limed to distinct alky, to phenolphthalein. Clarified juice is held neutral or slightly acid to phenolphthalein, but alk. to litmus. Kopke centrifugal separators were used on mud. An enlargement of the mud cone on the Dorr clarifier was made to permit greater compression of the settlings.

C. H. CHRISTMAN

The burning of cane to facilitate the harvesting. W. E. CROSS. *Planter and*

Sugar Mfr. 74, 308-10(1925).—Excessive labor costs in harvesting cane have caused many to burn the cane. Burnt cane is subject to rapid deterioration, through loss in juice and in sucrose. The rate of deterioration is affected by the temp. prevailing. After 4 days, cut unburnt cane deteriorated faster than burnt cane, cut or uncut. By zoning off areas sufficient for 1 or 2 days grinding, ill effects from burning are avoided.

C. H. CHRISTMAN

Cane juice p_H measurements. H. A. COOK. *Sugar* 27, 211-2, 264-5(1925).—Detn. of p_H with H electrodes gave results which were considered abnormal. A study of electrodes was made and it is supposed that the error was due to occlusion of protein which even a chromic acid wash would not remove. Freshly platinized electrodes gave consistent results and agreed well with the colorimetric data. Dilm. of the juice 1:9 causes an increase in p_H of 0.3, although this effect is greater q1 the less alk. juices. As a result of this work, it is recommended that not more than 6 detns. be made with an electrode. Detns. should be made on undiluted juice. Electrodes will last longer when the dilm. is 1:3, but the readings will differ 0.1-0.3 p_H from that of the undiluted juices. Directions for removing the Pt coating and replatinizing are given. 60-80 secs. coating with frequent reversals of current are recommended.

C. H. C.

Ash determination by the electrical method in juices and finished products of beet sugar factories. TÖDT. *Deut. Zuckerind.* 50, 745-6(1925); cf. *C. A.* 19, 3040.—This method is far more rapid than and 3 times as accurate as, the usual method. It can be used by non-technical operators.

W. L. BADGER

The influence of air removal on spindle readings on beet press-juice and remarks on methods of analysis for press-juice. FERDINAND KRYZ. *Z. Zuckerind. czechoslovak Rep.* 49, 491-3(1925).—Press juice from beet pulp was kept 25 min. under a vacuum of 700 mm., spindled, and this reading compared with that obtained from fresh juice. A juice of 10.9° Bx. spindled fresh, read 21.6° Bx. after removal of air; one of 20.7° was raised to 22.7° by the same method. Twenty-five samples ranging between these two all came up to 20-22° Bx. by removal of air. Allowing the juice to stand 0.5 hr. in an open flat vessel gave results 1.5-3.6° lower than the vacuum method. The refractometer gave Brix readings on fresh juices checking exactly with readings of the spindle after air removal.

W. L. BADGER

The polarization of molasses. J. J. WEISS. *Z. Zuckerind. czechoslovak. Rep.* 49, 324-2(1925).—A preliminary notice. Ofner's observations (*C. A.* 19, 3029) are confirmed by a careful study of standard samples in different labs.

W. L. BADGER

Further studies on the effect of fine grinding upon starch grains. C. L. ALSBERG AND E. E. PERRY. *Proc. Am. Soc. Biol. Chem.; J. Biol. Chem.* 63, lxvi-lxvii(1925).—"Battered starch grains (ground in a pebble mill) are still birefringent, although they no longer show the black cross under the polarizing microscope. They swell instantaneously when they come into contact with cold H_2O and to a considerable degree disperse themselves in it. They stain instantaneously in H_2O solns. of a number of dye stuffs as well as being dispersed in them. Uninjured starch grains are stained with the greatest difficulty. Solns. prepd. by extg. ground starch with H_2O at room temp. deposit a flocculent ppt. insol. in cold H_2O . However, not all the sol. matter is deposited. The soln. after weeks of standing still contains about 0.5% of a material which colors blue with I. It is pptd. from its solns. by EtOH and the ppt. can be redissolved in cold H_2O if it has not been permitted to become dry."

I. GREENWALD

Liquefaction of starch paste. P. PETIT. *Compt. rend.* 181, 259-60(1925).—To 150 g. of 2% starch paste was added 10 cc. of a soln. contg. NaCl 7 mg., KH_2PO_4 5 and lactic acid 2. The mixt. was shaken for several min. and allowed to stand a few hrs., when a clear mobile liquid without deposit was obtained. The operation was carried out in the presence of toluene to insure sterility of the liquid. The product filters slowly through paper, it is colored blue by I, it does not reduce Fehling soln. and it shows a rotatory power of 195°. Slight variations in the amt. of lactic acid added, retard or even prevent the liquefaction. The most favorable p_H for liquefaction is about 5.0. The slight amt. of silicate dissolved in the liquid seems to favor the liquefaction of the starch paste.

L. W. RIGGS

The salts of Mn, of Al and of I in the fertilization of the sugar beet (COSTA) 15. Changes in sugar content and rate of growth of beets as the result of variations in precipitation (URBAN) 11D. Influence of Al, Mn and Fe salts upon the growth of sugar cane (McGEORGE) 15. K values from residues of molasses fermentation (U. S. pat. 1,555,512) 18.

Utilizing residual waters from pressing beetroot. G. A. DURET. *U. S.* 1,552,737, Sept. 8. Residual waters from pressing beetroot and from juice extn. in sugar manuf.

are evapd. to a sirupy consistency at a temp. of 105–140° to obtain a product which may be used as *stock feed* or as a *fertilizer*.

Apparatus for continuous extraction of sugar from raw materials. A. OLIER.

U. S. 1,555,432, Sept. 29.

Multiple-effect evaporating apparatus for sugar solutions, etc. P. A. BANCEL.

U. S. 1,552,534, Sept. 8.

Multiple-effect evaporating apparatus for sugar solutions, etc. J. F. KIRGAN.

U. S. 1,552,562, Sept. 8.

Starch. P. W. ALLEN. U. S. 1,554,699, Sept. 22. In order to render starch, *e. g.*, corn starch, absorbent and suitable for use in wheat bread it is mixed with H₂O and with an acid such as dil. HCl and the mixt. is heated to effect drying and rupture of the starch cells without effecting, modifying, solubilizing or conversion to dextrin or dextrose.

Glucose. W. B. NEWKIRK. Brit. 232,160, April 11, 1924. See U. S. 1,508,569 (C. A. 18, 3736).

Sugar products resembling malt extract. VERSUCHS- UND LEHRANSTALT FÜR BRAUEREI. Brit. 213,219, March 19, 1923. In prep. products resembling malt ext. by heating sucrose with hydrolyzed albumin, yeast ext. or the like, the reaction is hastened by the addn. of HOAc or other acid, the mixt. being heated to above 80°.

Starch from corn. R. F. SHERMAN. U. S. 1,554,301, Sept. 22. Corn is steeped, disintegrated, the germs are sepd., the starch-bearing material is washed, the resulting starch liquor is returned to the germ separator, then filtered and the filtrate is removed with substantially all the residual sol. substances of the corn. The starch-bearing material is ground and treated with fresh H₂O, starch is sepd. and the resulting residual starch liquor is mixed with the starch from the filtering operation. The liquid obtained from the filtering operation is utilized for the subsequent steeping of grain.

29—LEATHER AND GLUE

ALLEN ROGERS

Coöperation between tanner and chemist—discussion. F. MOFFAT, *et al.* J. Am. Leather Chem. Assoc. 20, 475–85(1925).—An open discussion at the annual meeting, 1925.

J. A. WILSON

The distribution of tannin in the American chestnut tree with particular reference to stumps and roots. R. W. FREY and L. R. LEINBACH. J. Am. Leather Chem. Assoc. 20, 457–70(1925).—The stumps and roots of the American chestnut, *Castanea dentata*, and of the chestnut oak, *Quercus prinus*, contain about 15% tannin, suggesting their use as a com. source of tannin.

J. A. WILSON

Loss of weight of skins by draining after salting. HENRI VOURLAND. Cuir tech. 14, 356(1925).—Shrinkages up to 12% were observed. Effect of drainage on salt stains is discussed.

H. B. MERRILL

Origin and life cycle of grubs in cattle hides. J. L. WEBB. J. Am. Leather Chem. Assoc. 20, 453–6(1925).

J. A. WILSON

"Synthetic tannin," a useful modern product passing under a pseudonym. RAYMOND DRU. Cuir tech. 14, 348–51(1925).—The term "tannin" should be reserved for materials of vegetable origin. The use of the name "synthetic tannin" for sulfonated phenolic compds. is unfortunate. The admitted usefulness of such compds. in the tannery is not due primarily to their tanning action. Among their useful functions other than tanning are regulation of plumpness of skins, improvement of color, solvent action on insol. matter of vegetable tanning exts. and germicidal action.

H. B. MERRILL

Real and pseudo vegetable tans. C. SCHIAPARELLI AND C. AVENATI-BASSI. J. Soc. Leather Trades Chem. 9, 411–13(1925). (In Italian).—The boiling test of Fahrion may be used to det. the character of vegetable tans. Leather tanned with pure tannin (Kahlbaum) gelatinizes in water at 63–64°; with sumac ext. (Ledoğa), at 76°; with quebracho ext. (Levinstein), at 81–82°. From the industrial viewpoint, pure tannins act as pseudo-tans; this is due to their acidic nature. The tanning action of quebracho is due to its quinone or aldehyde groups, since aldehyde and quinone tannages are stable up to 80–82°. A table of *gelatinization temps. for mineral-tanned leathers* is given.

ROSALIE COBB

The influence of neutral salts on normal violet chrome alum. C. SCHIAPARELLI AND L. CAREGGIO. J. Soc. Leather Trades Chem. 9, 413–18(1925). (In Italian).—Using the *gelatinization temp.* as a criterion of tanning power, S. and C. compare the

action of various chrome salts on hide substance, and study the neutral salt effect. Normal chrome alum yields a product which is more resistant to heat than leather tanned with $\text{Cr}_2(\text{SO}_4)_3$. Addn. of K_2SO_4 to the $\text{Cr}_2(\text{SO}_4)_3$ soln. in amt. sufficient to form chrome alum, does not increase the stability of the leather over that made by the $\text{Cr}_2(\text{SO}_4)_3$ alone. In observing the neutral salt effect the results obtained by Burton and Thomas are not confirmed. Increasing NaCl concn. lowers the temp. of gelatinization from the 85° of chrome alum alone to 75° when NaCl = wt. of skin; time of tan, 18 hrs. Results are tabulated over ranges of several hundred hrs., showing effects of NH_4Cl , FeCl_3 , SnCl_2 and HgCl_2 . ROSALIE COBB

Dependence of reciprocal precipitation of gelatin and colloidal chromic oxide hydrosols on the equivalent aggregation of the chromic oxide micelle. Contribution to the theory of chrome tanning. R. WINTGEN AND H. LÖWENTHAL. *Kolloid-Z.* 34, 289-95(1924); cf. *C. A.* 17, 1743; 18, 1220, 2989, 3509.—At the point of max. pptn., in the mixing of Cr_2O_3 and gelatin sols, the no. of equiv. aggregates of Cr_2O_3 for a given quantity of gelatin is always the same for the same kind of gelatin, no matter what the degree of dispersion of the Cr_2O_3 sol. A value of about 30,000 is thus found for the mol. or equiv. aggregate weight of gelatin, which is in agreement with values found by osmotic measurements (cf. Biltz, *C. A.* 11, 735). Temp. rise, or the addn. of dil. acid or alkali, appears to cause a disintegration of these large aggregates. In technical chrome tanning liquors, ultrafiltration shows the presence of both colloidal and crystalloidal components. By expts. with Cr_2O_3 sols on gelatin leaves, and on solidified gelatin solns., it has been shown that a high degree of dispersity of the chrome sol is necessary for satisfactory tanning. B. C. A.

Contribution to the study of sole leather. CESARE SCHIAPARELLI. *J. Soc. Leather Trades Chem.* 9, 418-26(1925). (In Italian).—The lab. detn. of water-solubles in leather is not made under conditions corresponding to tannery practice. Sol. matter is divided into 4 classes: (A) The material most easily eliminated, sol. at room temp., (B) the substance sol. only above 50° (Procter) (this class gives to leather a certain impermeability), (C) less sol. than B; does not give a tannin reaction, (D) does not give tannin reaction, yet seems to add to the substance of leather. Tables show check detns. for A, B, and C. Successive expts. should be made, first in cold, then in warm water. Some leathers which are low in water-sol matter are high in water-absorbing power and tensile strength. ROSALIE COBB

A device for preparing light leather samples for analysis. R. W. FREY. *J. Am. Leather Chem. Assoc.* 20, 470-5(1925).—A hand-operated device in which the cutting is done by safety razor blades. J. A. WILSON

Provisional method for the determination of sulfates in chrome leather. H. C. REED. *J. Am. Leather Chem. Assoc.* 20, 448-9(1925).—The principle of the Thomas method is employed (cf. *C. A.* 14, 2102). Total sulfate is extd. by means of boiling NaH_2PO_4 soln. and neutral sulfate with water. The acid extd. with the neutral sulfate is detd. by titration with NaOH and deducted. The difference between total and neutral sulfates is recorded as combined acid sulfate. J. A. WILSON

The development of the German glue industry. OSKAR EISMANN. *Farben-Ztg.* 30, 1765-6, 1829-30, 1897-8, 2037, 2101, 2235(1925); cf. *C. A.* 19, 3035. F. A. W.

Electro-ultrafiltration of gelatin and glue (BECHHOLD, ROSENBERG) 2. Hardening gelatin (Brit. pat. 231,564) 18. Molded fiber articles (U. S. pat. 1,552,625) 18.

Destructive distillation of leather waste. J. MICHELMAN. Brit. 231,888, April 3, 1924. Leather waste is destructively distd. in closed chambers at about 600° for 6-12 hrs. and the volatile products are condensed, washed and collected. The C residue is of open porous texture suitable for use in clarification and decolorizing processes. If chrome leather waste is used, the Cr oxide may be recovered by burning the carbonaceous residue in an air current. With tannin-tanned leather scrap, the ammoniacal layer formed is sepd. from oily layers by treatment with CaCl_2 and evapn. of the supernatant liquor, thus obtaining NH_4Cl and hydroxy and carboxylic benzene derivs. or the NH_3 may be recovered as sulfate. Tarry and oily substances are washed with H_2O and pyrrrole, pyrocoll and pyrrrole derivs. remain as a residue.

Tanning. J. R. BLOCKEY AND W. WALKER & SONS, LTD. Brit. 230,879, Oct. 16, 1923. Swelling of hides and skins during tanning is controlled by regulating the pH of the tanning liquor and maintaining it const. during the whole process, by adding neutral salts such as NaCl .

Tanning composition. T. BLACKADDER AND H. C. REED. U. S. 1,555, 782, Sept.

29. A waste sulfite liquor prepn. is made with an acidity, expressed in terms of HOAc, equal to about 15% of the dissolved solids, and with substantially no ash-forming constituents other than CaSO_4 . This liquor may be used in tanning or plumping.

Purifying gelatin and glue. H. BECHHOLD. Brit. 232,077, June 26, 1924. A soln. of gelatin or glue is filtered through an ultrafilter membrane which may be prepd. from a 4% collodion soln. by coagulation with HOAc. The filtration may be repeated and may be facilitated by use of an elec. current.

30—RUBBER AND ALLIED SUBSTANCES

C. C. DAVIS

Latex preserved with sodium hydroxide. O. DE VRIES AND N. BEUMÉE-NIEUWLAND. *Arch. Rubbercult.* 9, 694-713(1925). (In English, *Ibid* 714-20.)—Latex may be preserved indefinitely by the addn. of 7-9 g. NaOH per l., while 6 g. is not always enough to prevent spontaneous coagulation after long keeping. As with latex preserved with NH_3 , the alkyl. of the latex to phenolphthalein remains const. or decreases slowly when it is greater than 0.07 *N* but decreases rapidly when below 0.05 *N*. Crepes from latex which had coagulated after the addn. of small amts. of NaOH vulcanized rapidly. The slope was normal but the tensile strength in some cases was low. The viscosity was at first high but decreased after keeping the rubber 2 yrs., though the rubber did not become tacky in this time. Crepes prepd. with HOAc immediately, 1 day, 1.5, 3.5, and 6 mos. after addn. of NaOH to the latex (5.78 g. per l.) cured in <35, <45, 80, 60, and 50 min. resp. (control 110 min.). The viscosity changed with the time of cure. The variation in time of cure was less marked when the latex was dild. before coagulation. None of these samples became tacky in 2 yrs. Latex preserved with 11 g. NaOH per l. for 2 years sepd. into 3 layers which were coagulated separately. Rubber from the top layer had a low viscosity, was abnormally plastic and cured in 55 min. That from the middle layer had a normal viscosity and plasticity and cured in 30 min. The tensile strength of both these layers was low. The lower layer was abnormally viscous and somewhat plastic. **Latex with larger amounts of sodium hydroxide.** *Ibid* 721-49, 750-60. —A stiff paste contg. 60% rubber formed in 1 or 2 weeks in latex contg. 2% NaOH and in 12 hrs. in latex contg. 5% NaOH. The paste remained in the same condition for a yr. or more and could be dild. with H_2O to a latex-like liquid. Rubber formed by drying the paste became tacky in a few weeks, while that prepd. with HOAc became tacky in a few mos. Dialyzed paste coagulated with EtOH gave a rubber which began to be tacky only after 2 yrs. This tackiness is attributed to a H_2O -sol. substance formed by the NaOH. The N content of crepes from pastes was low and decreased with increasing age of the paste, but the time of cure was about 40 min. regardless of the NaOH concn. and of the age of the paste. The rubber was very weak and plastic.

F. H. YORSTON

Why does latex rubber become tacky even after vulcanization? RUDOLF DITMAR. *Gummi-Ztg.* 39, 2285-6(1925). —A film of rubber obtained by evapn. of latex preserved with NH_3 becomes tacky when exposed to the air in summer, but if maintained artificially at a similar temp. in winter this tackiness does not appear. In the latter case the humidity is lower, and if the film is preserved over CaCl_2 in summer it likewise does not decompose. Furthermore a film obtained by evapn. of a C_6H_6 soln. does not decompose under those conditions most favorable to decompn. of the evapd. latex. This differing behavior of evapd. latex and an evapd. C_6H_6 soln. is due in part to the NH_3 dispersed in the globules (cf. Ditmar, *C. A.* 19, 1792) and in part to the fact that in latex rubber the tackiness is due to decompn. of the protein envelope, whereas in rubber from C_6H_6 soln. the globules have been destroyed and a coating of rubber protects the protein from decompn. This latter assumption is supported by the fact that brief treatment of latex rubber with C_6H_6 renders it far less prone to decompn. Tackiness which always appears in latex rubber vulcanized with S_2Cl_2 is ascribed to the fact that the S_2Cl_2 does not penetrate the protein covering and react with the rubber but is merely absorbed by the protein, where with H_2O it slowly forms HCl and S or with H_2O and air forms H_2SO_4 . The H_2SO_4 renders the vulcanized rubber nuclei tacky. Likewise in the hot vulcanization of an evapd. emulsion of latex with S, true vulcanization of the rubber does not occur, for the S is inhibited by the protein covering from reaching the rubber. By milling the mixt. before vulcanization, however, the protein covering of the globules is broken, S comes in contact with the rubber, true vulcanization results and the vulcanized product does not become tacky.

C. C. DAVIS

The examination of raw materials in the rubber industry. II. PAUL MENSIER. *Rev. gén. caoutchouc* 1925, No. 14, 15-6; cf. *C. A.* 19, 3386.—Suggestions for the examn. of talc, ZnO, lithopone, PbO, MgO, lampblack, Sb sulfide and S are given. C. C. D.

Colloidal litharge in the rubber industry. RUDOLF DITMAR. *Rev. gén. caoutchouc* 1925, No. 14, 3-5.—Colloidal PbO (0.0001-0.00001 mm. diam.) can be dispersed more uniformly in rubber than ordinary PbO (0.01 mm. diam.) and as an accelerator it greatly increases the rate of vulcanization and gives a vulcanized product of superior texture, toughness and durability. Comparative tests with different mixts. are given to illustrate these effects. C. C. DAVIS

Bulk test with *p*-nitrophenol (as a mold preventive). H. P. STEVENS. *Bull. Rubber Growers' Assoc.* 7, 419-20(1925); cf. *C. A.* 19, 2145.—The efficacy of *p*-nitrophenol as a mold preventive was again demonstrated in an expt. with a case of smoked sheet. The results of vulcanization tests on moldy and on treated sheets were similar to previous ones (cf. *C. A.* 19, 749). F. H. YORSTON

2,4-Dinitrophenol (in rubber preparation). H. P. STEVENS. *Bull. Rubber Growers' Assoc.* 7, 359-60(1925).—A satisfactory vulcanizate was prepd. under ordinary conditions from a mixt. contg. 1% of 2,4-dinitrophenol. F. H. YORSTON

The accelerator B. B. A. D. LUTTRINGER. *Caoutchouc & gutta-percha* 22, 12814-7 (1925).—"B.B.," a deriv. of dimethyl-*p*-phenylenediamine, is a brownish black sirup which has a powerful plastifying action on rubber and is an accelerator of wide application. Its accelerating power is increased by ZnO, PbO, MgO, etc. The best results can be obtained with 0.25-0.50% B.B. and 5% S based on the rubber and with ZnO, under which conditions high tensile strength, resilience and resistance to tearing and abrasion and very good aging properties are obtained. With greater amts., vulcanization can be carried out at low temps. or in very short times. Typical formulas contg. B.B. for press, steam and dry heat cures are given, together with a comparison of the oven aging of a mixt. contg. B.B. with the same base mixt. contg. several other accelerators. C. C. DAVIS

Accelerators and their use. L. STOLL. *Rubber Age* 17, 407-10, 418(1925); cf. *C. A.* 19, 2145.—A review of the development of inorg. and org. accelerators and their properties, with a bibliography of 133 references. C. C. DAVIS

The recovery of rubber solvents by highly active carbon according to the Bayer and the Metallbank processes. RUDOLF DITMAR. *Caoutchouc & gutta-percha* 22, 12810-2(1925).—A description, with diagrams, of the recovery of solvents by the Bayer (cf. Berl and Andress, *C. A.* 15, 3194; 16, 450; Carstens, *C. A.* 16, 2374) and the Metallbank processes. The latter differs from the former in that heat losses are minimized by utilizing the counter-current principle. The air contg. the vapors to be recovered passes up through a mass of active C which is slowly descending through a constriction into a lower chamber. The latter is composed of tubes heated externally by gas, through which the satd. C passes and where the vapor is expelled. At the top and the bottom of this recovery system inert gas flows in and after sweeping through the C flows out at the middle section into a condenser where the entrained vapor is recovered. The regenerated C continues downward into a cooling chamber at the bottom and is then returned to the top of the system where it again starts its downward path through the adsorption chamber. C. C. DAVIS

The action of light on rubber. KEIICHIRO ASANO. *India Rubber J.* 70, 307-10 347-52, 389-96(1925).—Expts. were directed toward explaining the nature of the changes in raw rubber induced by radiation of different wave lengths both in inert gases and in air. Sheet rubber and films obtained by evapg. a C_6H_6 soln. *in vacuo* in darkness were exposed at about 40° and in all cases the product was examd. for changes in soly., decrease in viscosity (d-polymerization) and oxidation. The radiation included wave lengths from the infra-red to those shorter than 2000 A. U., as well as sunlight. When rubber was exposed to ultra-violet light in inert gases such as CO_2 , N or H it was converted in part to a white, opaque, brittle, polymerized substance insol. in C_6H_6 and in part to a depolymerized, tacky product, the 2 products having much the same compn. In CO_2 the O content did not increase to a degree indicating that the insol. substance was an oxidation product and control tests of the action of ultra-violet light on CO_2 failed to reveal the formation of CO and O (cf. Bruni, *C. A.* 16, 4093). On exposure to ultra-violet light and air 2 products were again formed, a tacky, transparent mass sol. in C_6H_6 of reduced viscosity (indicating depolymerization) and an opaque, brittle substance sol. in C_6H_6 . Comparison of the action of each part of the spectrum showed that the visible part and the ultra-violet down to about 3100 A. U. passed through the rubber and had no significant effect. Between 3100 and 2250 A. U. a strong fluorescence appeared and below 2250 A. U. the light was completely absorbed. In conformity with

this, the phys. and chem. changes in the rubber were most rapid and profound in the region 2250–2000 A. U., indicating selective absorption of light by rubber. In rubber films dyed various colors with org. dyes the action of the spectrum extended to longer wave lengths than in undyed rubber, and for a given wave length the action was more severe in dyed rubber, indicating a greater absorptive capacity of the colored rubber, with its max. below 2250 A. U. as with uncolored rubber. Only in sunlight where there was almost no radiations below 2910 A. U. did oxidation occur to any considerable extent. Exposure to sunlight caused tackiness, followed by brittleness, the ultimate product being insol. in boiling C_6H_6 , $CHCl_3$, $EtOH$ or Me_2CO , and contg. 14.6% O. The action involved an initial depolymerization, with subsequent accelerated oxidation of the depolymerized product. This oxidation was induced by light of wave lengths below 5000 A. U., while the depolymerization was effected by longer wave lengths. Elimination of the heat effect by filtering the light through H_2O did not alter its effect on the rubber. Under all conditions the intensity of the light governed the rapidity with which the changes were brought about, in conformity with the general laws of photochem. action. As a protection against oxidation induced by light, light with wave lengths below 5000 A. U. should be excluded and rubber may also be protected by a dense layer of dye to reduce the intensity (quantity) of light and thus inhibit depolymerization. In practice this can be accomplished by storing the rubber in red, orange or yellow light. As an aging test for rubber it is recommended that the samples be maintained at 71° in a steady current of air and at the same time be exposed to artificial ultra-violet light until the changes are of sufficient magnitude to compare the stress-strain curves and the chem. compns. A bibliography of 49 references to work on the action of light on rubber is included. C. C. DAVIS

Some problems of the paint and rubber industries. B. D. PORRITT. *J. Oil Colour Chem. Assoc.* 8, 139–58(1925).—A review of the prepn. and compn. of raw rubber, its chem. and phys. properties, vulcanization accelerators, effect of aging vulcanized rubber, etc., and of the analogy between the vulcanization of rubber and the drying of oils. Discussion and references. F. A. WERTZ

Paving compositions having a rubber base (ARNAUD) 20. The adsorption properties and particle size of several lampblacks in organic liquids and in crude mixtures, as well as the effect of these lampblacks on the properties of vulcanized products (LE BLANC, *et al.*) 2. Molded fiber articles (U. S. pat. 1,552,625) 18.

Rubber composition. J. MCGAVACK. U. S. 1,555,131, Sept. 29. A compn. which resembles hard rubber and bakelite is formed from rubber, an aldehyde, a phenol and a halogen, *e. g.*, by treating a rubber soln. in CCl_4 with Cl , $PhOH$ and formaldehyde.

Rubber composition. W. S. GAUNTT. U. S. 1,553,438, Sept. 15. A resilient compn. adapted for making tires comprises rubber gum, zapote gum, ZnO , metallic wool and S.

Rubber compositions. A. JEFFREY and B. WILKINSON. Brit. 232,015, March 18, 1924. An oxide or sulfide of Pb, Sb, Mg or Zn (or mixts. of these) and S are added to latex and the mixt. is coagulated by stirring or agitation alone. The coagulum is removed from the serum and made directly into tiles, mats, boot soles, leather substitutes or other articles.

Rubber compositions. R. RUSSELL and H. BROOMFIELD. Brit. 231,988, Feb. 26, 1924. A spongy, non-adhesive compn. suitable for use in rubber mixts. is prepd. by mixing heated latex with a heated aq. soln. of glue, gelatin, etc., and adding a coagulant for the latex and a hardener for the glue. NH_3 and formaldehyde may be used and oils, treacle and fillers may be added.

Colored rubber articles. W. G. MARTIN and NORTH BRITISH RUBBER CO., LTD. Brit. 232,421, May 12, 1924. Colored rubber articles assembled from pieces of vulcanizable sheet rubber and vulcanized by the dry heat process are made from sheet contg. piperidine pentamethylenedithiocarbamate or other accelerator of similar type.

Crude rubber from latex. R. HOPKINSON. U. S. 1,550,319, Aug. 18. Latex is desiccated to obtain all of its solid constituents and these are heated to produce a mass of dark color throughout, adapted for working and vulcanizing.

Molds for rubber. G. HAKANSON. U. S. 1,550,160, Aug. 18. In prepg. molds of vulcanized rubber for articles of soft rubber with a surface decoration in resemblance to textile fabric, a textile pattern is impressed on the non-vulcanized mold material and the latter is vulcanized with the pattern in place. The pattern is destroyed after vulcanization.

Rubber repair patch. H. H. THEIS. U. S. 1,553,883, Sept. 15. Gum rubber is applied to one side of a layer of cured rubber and the outer face of the gum rubber is treated with a skim coat comprising benzine 2 and "cold patch cement" 1 part. This is covered with a protecting fabric sheet impregnated with starch.

Vulcanizing rubber. E. ROMANI. U. S. 1,555,256, Sept. 29. Zn α -phenylbi-guanide is used as a vulcanization accelerator.

Vulcanizing rubber. S. M. CADWELL. U. S. 1,552,820, Sept. 8. Rubber is mixed with S, Pb dithiobenzoate and Pb oxide, and then vulcanized.

Masticating rubber. H. C. YOUNG and C. MACBETH. U. S. 1,556,141, Oct. 6. Mech. features.

Bearings of rubber. C. W. JOHNSON. U. S. 1,555,214, Sept. 29. Bearings for shafts of automobile steering column, etc., are formed with a backing of soft rubber integrally united with a hard rubber bearing facing contg. a small proportion of a lubricant such as graphite.

CHEMICAL ABSTRACTS

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("P" before a page number indicates "Patent")

NOTE.—In the transliteration of names originally written in Russian, the system followed so far as possible is that of *Nature* (Feb. 27, 1890), in which *v* is used instead of the *w* or *ff* of other spellings, *sh* instead of *sch*, *ch* instead of *tsh*, *i* instead of *j* or *y*, etc. Thus Pavlov, not Pawlow; Chugaev, not Tschugaev. To make quite sure, users of the index should in such a case look under both spellings.

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SUBJECT INDEX

KEY

In using this index the following should be borne in mind:

1. **Subjects**, not words, have been indexed.
2. **Abstracts**, not merely their titles, have been considered in indexing.
3. The small superior numeral which accompanies each page number designates the fraction of the page in which the subject being indexed is first considered. The printed matter only, exclusive of page headings, has been thus subdivided.
4. "P" before a page number indicates that the abstract is of a patent.
5. The **alphabetizing of index headings** has been done on the basis first of that part which comes before the comma in such headings as *Copper, metallurgy of* and *Phenol, p-nitro-*. E. g., these headings come before the headings *Copper compounds* and *Phenol condensation products*, respectively.
6. **Organic compounds** are indexed on the basis of "parent compounds," or more accurately "index compounds" (see Introduction), the names of substituent radicals following in alphabetical order. The system of naming organic compounds which has been used is outlined in the Introduction below. Esters and salts of organic acids are, in general, indexed under the names of the acids; notes in the index under the appropriate headings explain the few exceptions.
7. An **asterisk (*)** following the name of an organic compound entered in the index signifies that the name, or numbering, or both, is the author's own and may not conform to the system of nomenclature used in this index. This sign is used where it has seemed inadvisable, owing to incomplete information, to attempt to make the name conform to the system, or where the author's name, differing widely from the one given to the compound by the indexer, is given as an extra entry.
8. A **dagger (†)**, which follows the names of a few compounds, signifies that the entry is an extra one, the name being only slightly less favored than the one chosen for the other entry. The preferred name can be determined by reference to the Formula Index.

The desirability of making the index readily usable without the need of reference to an elaborate introduction has been held constantly in mind. Although an introduction seems desirable and should be helpful, nevertheless the index is dependent neither on the Key nor on the Introduction. Numerous cross-references are given throughout the index, and notes appear in connection with certain headings. An examination of the Introduction, which follows, should be especially helpful to those interested in looking up organic compounds.

INTRODUCTION.

General policy. The indexing of subjects, as opposed to word-indexing, has been emphasized. This avoids omissions, scattering and unnecessary entries; with the abundant cross-references used it means that one should be able to find all of the references on any subject with certainty and with a minimum of effort. The words used as subject headings or in modifying phrases are not necessarily to be found in the abstracts but an expression of the idea suggested will be found within or beginning in the ninth of the page designated by the small superior numeral following the page number. Chemical compounds have been named and entered systematically; the system used is outlined below. All new compounds and all elements, compounds and other substances for which new data are given have been indexed, with the single exception of new compounds for which no name or structure has been given. Such compounds are entered only in the Formula Index. The Subject Index is in no other respect altered because of the Formula Index.

Modifying phrases. In writing such phrases for the entries under any heading the words have been arranged so that the idea considered to be the most important is expressed at the beginning whenever feasible and this procedure, as well as the selection of the words for this purpose, has been governed by numerous formulated general principles and specific rules. *E. g.*, "detection of" has been used consistently whenever correct at the beginning of the modifications in indexing subjects treated from a qualitative analytical point of view, instead of permitting a scattering under such additional phrases as "test for," "reaction for," etc., regardless of what words may have been used in the text. In the case of appropriate headings the selection of first words for modifications has been made on the basis of a definite system of classification. Under a few large headings two or more entries have been made on indexing a subject in a single abstract in case two or more ideas could be used equally well to start the modifying phrase. In alphabetizing modifying phrases prepositions at the beginning have been ignored.

References to fractions of the page. One can readily estimate ninths of a page with considerable accuracy by placing the fore or middle finger one-third of the distance from the top of the printed matter on the page and the thumb one-third of the distance from the bottom, a procedure very easily carried out.

Inorganic compounds. Simple inorganic compounds are entered under the usual names. In indexing compounds of iron, gold, copper and tin such headings as *Iron sulfates*, under which both the "ous" and "ic" salts are entered, have been used rather than headings beginning with "ferric(ous)," "auric(ous)," "cupric(ous)," or "stannic(ous)." Acid salts, such as NaH_2PO_4 , are entered under such headings as "*Sodium phosphates*." With the exception of a few very common compounds, such as carbon dioxide and carbon monoxide, compounds of a given element with another or with a definite radical, which differ only in valence relations, are grouped. *E. g.*, the various oxides of nitrogen are grouped under the heading "*Nitrogen oxides*" and classified there. Complex inorganic compounds which cannot be given definite names satisfactory for indexing are usually indexed under the heading which represents the class of compounds concerned and under a heading of the type *Nickel compounds*, depending on what the significant element is. *E. g.*, dichlorotetraamminecobaltic chloride would be indexed under "*Ammino compounds*" and under "*Cobalt compounds*." The Formula Index, which follows this one, should be particularly helpful in locating complex compounds.

Organic compounds. The system used for naming and indexing organic compounds is the same as that in use starting with the 1916 volume. An explanation of it by

Austin M. Patterson and Carleton E. Curran, who are its originators, has appeared in another journal of the Society.¹ The system is based on existing usage and follows this as far as is practicable, so that a great many familiar names are unaffected. Only the general principles will be given here, but in the index itself will be found abundant cross-references and also notes under *Alcohols*, *Ketones*, etc., indicating how compounds of these classes are named.

1. The chief function of a compound is expressed in the main part of the name wherever possible, and not as a substituent, thus: Pyrrolecarboxylic acid, not carboxypyrrole; ethyl alcohol or ethanol, not hydroxyethane; pentanone, not ketopentane.

2. In compounds of mixed function, the chief function is determined from the following order of precedence: "onium" compounds,² acid (carboxylic first), acid halide, amide, imide, aldehyde, nitrile, ketone, alcohol, phenol, mercaptan, amine, imine, ether, sulfide (and sulfoxide and sulfone). Thus, hydroxybenzonitrile, not cyanophenol; aminophenol, not hydroxyaniline.

3. A multiple chief function is expressed where feasible as -diol, -dicarboxylic acid, etc., rather than as hydroxy—ol, carboxy—acid, etc. But amino and imino groups attached to cyclic bases are treated as substituents; as, aminopyridine.

4. The parent compound should be as large, and the substituents as small, as is practicable in conformity with the above rules; as, ethylbenzene, not phenylethane. But such names as diphenylethane and triphenylcarbinol are exceptions. When the chief function is in a side chain attached to a complex nucleus, "additive" names are preferred in order to harmonize 1 and 4; thus, naphthaleneacetic acid, not naphthylacetic acid (with the result that the compound is indexed with other naphthalene derivatives instead of under acetic acid; see 5).

5. The main part of the name with its functional ending, if any, is placed first in the index, the names of substituents following; thus, chloroacetic acid would appear in the index as *Acetic acid*, *chloro-* and dihydroxyanthraquinone as *Anthraquinone*, *dihydroxy-*. The part thus placed first is called the "index compound;" it may or may not be the "parent compound" (in the second example the parent compound is anthracene).

6. Names in which two functions are expressed in the index compound, as propanolone, cyclopentanonecarboxylic acid, are avoided, but a few very common ones, such as phenolsulfonic acid, are used (indicated by cross-references).

7. The names of the substituent radicals in the name of a compound are arranged in alphabetical order; as, benzylethylmethylphenylammonium chloride. The number of radicals of each kind does not affect the order (e. g., *benzyl* precedes *ethyl* no matter how many of each is present); but the compound name of a substituted radical is treated as a unit with its own alphabetic position; thus *dimethylamino*, Me₂N-, follows *benzyl* but precedes *ethyl*. When the complete name has been formed, it is alphabetized as any other word.

8. Parentheses, brackets and even braces are used where necessary to mark off complex radical names.

9. Familiar methods of numbering are employed (Greek letters for acids, alcohols, etc., and for side chains; arabic numerals for Geneva names and rings). The numbering of complex nuclei is shown in the index under the parent compounds; it is practically identical with that of Richter's "Lexikon" as far as that work goes.

10. When two or more numberings are possible that one is chosen which gives

¹ Patterson and Curran, *J. Am. Chem. Soc.* 39, 1623-38(1917).

² Though "onium" does not designate a function in the strict sense, compounds of this type are often, though not always, named as though it were a chief function.

the smallest number or numbers for the *chief function*, then for double bonds if these must be regarded, then for triple bonds, then for point of attachment (doubled molecules), then for substituents.

11. Unnecessary numbers are avoided: thus, in Δ^3 -1-cyclohexanol the 1 is not needed because by the rules in paragraph 10 the OH group is assumed to be in position 1.

12. Numbers in parentheses are used to indicate the position of entering hydrogen necessary to the existence of the compound; thus, 4(3)-quinolone is equivalent to 3,4-dihydro-4-ketoquinoline.

13. Doubled molecules or radicals are indicated by names commencing with *bi-* (as, *o,o'*-biphenol, biphenyl, $\Delta^{4,4'}$ -bipiperidine). *Bis-* is used for like molecules united by a bivalent radical; as, methylenebisphenol.

In using the *cross-references*, the *general* nature of many of them should be kept in mind; thus, the reference "*Benzene, ethoxy-*. See *Phenetole*" is applicable not only to this compound itself but to derivatives, which are indexed under it rather than under *Benzene*.

ORGANIC RADICALS

An extensive list of preferred names for organic radicals was given in the 1914 Index in a place corresponding to this and also in the Introduction of the Decennial Subject Index. With few exceptions they are the ones in common use. Attention is here called merely to the preferred names for some radicals having more than one name in the literature and to some radical names recently adopted.

acenaphthenyl $C_{12}H_9-$

acetyl CH_3CO-

acridyl $C_{13}H_9N-$

acrylyl $CH_2:CHCO-$

amyl $C_5H_{11}-$

anisal *p*- $MeOC_6H_4CH-$

arsono $(HO)_2OAs-$

arsyl H_2As-

arsylene $HAs-$

*benzal C_6H_5CH-

benzyl $PhCH_2-$

benzohydril Ph_2CH-

boryl $O:B-$

1,4-butylene $-(CH_2)_4-$

camphanyl (from *camphane*) $C_{10}H_{17}-$

camphoroyl (from *camphoric acid*)

$C_8H_{14}(CO)_2-$

camphoryl (from *camphor*) $C_{10}H_{18}O-$

camphorylidene (from *camphor*) $C_{10}H_{14}O-$

carbamido $H_2NCONH-$

carbamyl H_2NCO-

carbethoxy $EtOOC-$

carboethoxy $MeOOC-$

cetyl $Me(CH_2)_{15}-$

cinnamal $PhCH:CHCH-$

cresotyl (from *cresotic acid*)

2,3-(OH)(CH_3) C_6H_3CO-

cresyl (OH) MeC_6H_5-

cumal *p*- $Me_2CHC_6H_4CH-$

epoxy, oxy $-O-$

ethynyl $HC:C-$

ethylene $-CH_2CH_2-$

fenchyl (from *fenchyl alcohol*) $C_{10}H_{17}-$

fluorylidene (from *fluorene*) $C_{13}H_8-$

formyl $OHC-$

fural C_4H_3OCH-

furyl C_4H_5O-

furylidene (2 isomers) $CH:CH.O.CH_2.C$

hippuryl $PhCONHCH_2CO-$

indylidene (from *indole*) C_8H_7N-

isonitro $HOON-$

isonitroso $HON-$

isopropenyl $MeC:(CH_2)-$

keto $O-$

mercapto $HS-$

mesityl (from *mesitylene*)

3,5-(CH_3) $C_6H_2CH_2-$

methylioyl $-SO_2CH_2SO_2-$

naphthal $C_{10}H_7CH-$

naphthylidene $C_{10}H_7-$

perthio* (replacing *O* only) $S:S-$

phenacylidene $PhCOCH-$

phenanthrylene (from *phenanthrene*)

$C_{14}H_8-$

phenylenedisazo $-N:NC_6H_4N:N-$

phthalidyl (<i>from phthalide</i>) $\text{C}_6\text{H}_4\text{CO.O.CH-}$	selenyl HSe-
pivalyl (<i>from pivalic acid</i>) $(\text{CH}_3)_3\text{CCO-}$	stannyl $\text{H}_3\text{Sn-}$
propenyl MeCH:CH-	styryl PhCH:CH-
propenylidene $\text{CH}_2\text{CH:C:}$	sulfinyl OS:
pyranyl $\text{C}_5\text{H}_5\text{O-}$	sulfonyl $\text{O}_2\text{S:}$
pyridylidene $\text{C}_5\text{H}_5\text{N:}$	terephthalal (<i>from terephthalaldehyde</i>)
quinonyl $(\text{O:})_2\text{C}_6\text{H}_3\text{-}$	$\text{:HCC}_6\text{H}_4\text{CH:}$
quinoxalyl (<i>from quinoxaline</i>) $\text{C}_8\text{H}_6\text{N}_2\text{-}$	toloxy $\text{MeC}_6\text{H}_4\text{O-}$
salicyl $o\text{-HOC}_6\text{H}_4\text{-}$	toluino $\text{MeC}_6\text{H}_4\text{NH-}$
salicylal $o\text{-HOC}_6\text{H}_4\text{CH:}$	α -toluyl $\text{PhCH}_2\text{CO-}$
salicylyl $o\text{-HOC}_6\text{H}_4\text{CO-}$	tolyl $\text{MeC}_6\text{H}_4\text{-}$
	triazol $\text{N}_3\text{-}$

RING INDEX

The following index of *ring complexes* is arranged as shown by the bold-face figures: Class I, with single figures indicating simple rings of 3, 5, etc., members; Class II, two figures denoting double rings of 3 and 4, 3 and 5, etc., members; then the triple and still more complex rings. Under each combination of figures the kind and number of atoms in the ring or rings are expressed in formulas. These formulas are arranged so that their initial rings are in the same order as in the Formula Index (see Key at the beginning of it). If the initial rings are alike the second rings of the formula are considered, and so on. By this means the reader will be able to learn the name used in the index for the simplest parent compound containing any particular ring or combination of rings and by turning to this name in the index he will find the compounds listed and, perhaps, cross-references to names of derivatives. Rings which are united but which have no atoms in common (*e. g.*, biphenyl) and "spiro" compounds¹ which are characterized by two rings having but one atom in common are not regarded as ring complexes nor included in this index.

To illustrate: **6,6,6**, $\text{C}_4\text{N}_2\text{-C}_6\text{-C}_6$ Benzoquinoxaline
Phenazine

(1) This designates a complex ring of three components, each of six members; (2) the first is heterocyclic, containing four carbon atoms and two nitrogen atoms and the other two are carbocyclic rings of six atoms each; (3) parent compounds of this configuration will be found in the index under the two names given. If derivatives are indexed a structural formula will be found with the proper numbering and also appropriate cross-references to derivs. having other common names, if any such are in the index.

It should be noted that the classification is made with reference to the smallest rings which, placed together, will constitute the plane formula. Thus hexamethylene-tetramine is treated as a 6,6,6 complex although a fourth six-membered ring (composed of atoms from the three six-membered rings) is also present.

1	C_2O . Ethylene oxide	$\text{C}_2\text{N}_2\text{P}$. Diazphospholium, phenoxy-P-thiodi
3	C_3 . Cyclopropane	hydro-*
4	CN_3 . Triazete	$\text{C}_3\text{N}_3\text{S}$. Thiodiazole
	C_3N_3 . Diazene	C_3N_3 . Triazole
	Urete	C_3NO . Isoxazole
	C_4N . Trimethylenimine	Oxazole
	C_4 . Cyclobutane	C_4NS . Thiazole
5	CN_4 . Tetrazole	C_4N_2 . Imidazole
	$\text{C}_2\text{N}_2\text{O}$. Furazan	Pyrazole
	Oxdiazole	C_4OS . Thioxole
		C_3O_2 . Dioxole

¹ All members of this class will be found together under "Spiro-" in the Subject Index.

- C₄N.** Isopyrrole
 Pyrrole
C₄O. Furan
C₄S. Thiophene
C₅. Cyclopentane
6 C₅N₂O₂. Dioxdiazine
C₅N₄. Tetrazine
C₅N₂O. Oxdiazine
C₅N₂S. Isothiodiazine
C₅N₃. Triazine
C₅O₃. Trioxane
C₄AsS. Thiarsane
C₄N(O). Oxazine
C₄NS. Thiazine
C₄N₂. Pyrazine
 Pyridazine
 Pyrimidine
C₄O₂. Dioxin
C₆N. Pyridine
C₆O. Pyran
 Pyrilium
C₆Te. Telluropyran
C₆. Benzene
 Cyclohexane
 Cyclohexene
N₄P₂. Tetrazdiphosphonium, *P,P'*-diphenoxy-
 P,P'-dithio-*
7 C₆N₄. Compd., m. 220°, from thiocarbo-
 hydrazide and glyoxal sodium bi-
 sulfite compd., 22067
C₄S₃. Diethylene 1,2,5 - trisulfide*
C₇. Cycloheptane
10 C₈O₂. Glutaric acid, β -keto- $\alpha,\alpha,\gamma,\gamma$ -tetra-
 methyl-, cyclic anhydride with di-
 methylmalonic acid
C₈O. Pelargonaldehyde, θ -hydroxy, hemi-
 methylacetal
C₁₀. Cyclodecane
- II**
3,5 C₃-C₄O. 1,2 - Cyclopropanedicarboxylic
 anhydride
3,6 C₃N-C₆. Cycloiminotoluquinone*
C₂O-C₆. Cyclohexane, 1,2 - epoxy-
C₃-C₆. Norcarane
4,4 C₂N₂-C₂N₂. 4 - Triazetidinecarboxylic acid,
 4,2 - inner anhydride, 2852
4,6 C₃N-C₆. Benzazete
C₄-C₆. Norpinane
 Pinene
5,5 C₂N₂-C₅ Piperidazine, endomethylene-*
C₄N-C₄N. Pyrrolopyrrole
C₄N-C₄O Furrolyrrole
C₄O-C₄O. Furofuran
C₈-C₈. Bicyclo [0.3.3]octane
 Norcamphane
5,6 C₂N₂P-C₆. Benzodiazphospholium, *p*-tolyl
 oxy-*P*-thio-dihydro-*
C₂N₃-C₆. Benzotriazole
C₂AsO-C₆. *o* - Carboxyphenylchloroarsin-
 ous anhydride*, 4797
C₂HgO-C₆. Benzoic acid, 4-benzyloxy-2-
 hydroxymercuri-, lactone
C₃NO-C₆N₂. Serine, *N* - glyceryl-, anhy-
 dride
C₃NO-C₆N. Piperidinium compds., 3-
 hydroxy - 5 - carboxy - (V-
 dimethyl— bromide, betaine
 3084
 Trigonelline*
C₃NO-C₆. Anthranil
 Benzisoxazole
 Benzoxazole
C₂NS-C₆. Benzisothiazole
- Benzothiazole**
C₂NSe-C₆. Benzoselenazole
C₂N₂-C₄N₂. Purine
C₂N₂-C₆N. Imidazopyridine
C₂N₂-C₆. Benzimidazole
 Indazole
 Isoindazole
C₃OS-C₆. Benzisothioxole
C₃O₂-C₆. Cyclohexane, methylenedioxy-;
 piperonal, etc.
C₄N-C₄N₂. Pyrrolopyrazine
 Pyrrolopyridazine
C₄N-C₆N. Isopyrrolopyridine
 Nortropidine
 Pyrrolenopyridine
 Pyrrolopyridine
C₄N C₆. Indole
 Isoindole
 Pseudoindole
 Pseudoisindole
C₄O-C₆N. Nipecotie acid, 5-hydroxy, γ -
 lactone
C₄O-C₆. Benzofuran
 Isobenzofuran
C₄S-C₆N. Pyridothophene
C₄S-C₆. Isothionaphthene
 Thionaphthene
C₅-C₆O. Pyrone derivs., 29338,9
C₆-C₆. Indene
6,6 C₃N₄-C₆. Benzotriazine
C₄N(O)-C₆. Benzoxazine
C₄N₂-C₆N. Pyridopyrazine
 Pyridopyrimidine
C₄N₂-C₆. Quinazoline
 Quinoxaline
C₆N-C₆N. Coprine
 Granatanine
 Naphthyridine
 Pyridopyridine
 Quinuchidine
C₆N C₆S. Thiopyranopyridine
C₆N-C₆. Isoquinoline
 Quinoline
C₆O-C₆O. Pyranopyran
C₆O-C₆. Benzopyran
 Benzopyrylium
 Compds. IV, - m. 119-20°, and
 V, m. 196-7°, and diphenyl
 pyrone derivs., 29339, 29341
C₆-C₆. Naphthalene
6,7 C₈-C₄N₂O. 4,5 - Benzo - [hept - 1,2,6-
 oxdiazine]
C₈-C₆O. Spiro compound from bis(β phen-
 oxyethyl)malonyl chloride, 621
6,8 C₂N₂O₂ C₄N₂O₂. 1,2,3,4 - Butanetetraone,
 tetraoxime, diperoxide
 2,3,4,5 - Hexanetetraone,
 tetraoxime, diperoxide
- III**
3, 5 C₃-C₃-C₃. Tricyclo[2.2.1.0^{2,5}] heptane
3, 6 C₃O-C₆-C₆. Naphthalene, 1,2 - epoxy-
4, 10 C₄-C₄-C₁₀. Cyclodecanebiscyclobutane
 dione*
4, 6 CN₂-C₂N₂-C₆. Triazetindazole
4, 6 C₄-C₄N₂-C₄N₂. Bisuracil
5, 6 C₂N₂-C₃-C₆. Indenotriazole
C₄NO-C₆NO-C₆. Benzobisoxazole
C₃N₂-C₄N₂-C₆. Quinoxaline, 1,4 - *endo*-
 keto - 2 - keto - 3,5-
 diphenyltetrahydro-
C₃O₂-C₃O₂-C₆. Bisacetonequinamide*
C₃O₂-C₄O-C₆. Acetonequinide*
C₄N-C₄N-C₄N₂. Dipyrrolopyrazine

- $C_4N-C_4N-C_6$. Pyrroloindole
 $C_6-C_7-C_8O$. Trimethylencamphane oxide*
- 5, 6, 6** $C_2N_3-C_6-C_6$. Naphthotriazole
 $C_2NS-C_2N-C_6$. Isothiazoloquinoline
 $C_2N_2-C_2N_3-C_6$. Triazinobenzimidazole
 $C_2N_2-C_6-C_6$. Naphthimidazole
 $C_6O_2-C_6N-C_6$. Quinoline, 6,7-methylene-dioxy-
 $C_4As-C_6-C_6$. Arsine, *o, o* - diphenylene-*
 $C_4N-C_6N-C_6$. Isopyridindole
 C_4N-C_6 . Carbazole
 C_4N-C_6 . Naphthazole
 C_4N-C_6 . Pseudonaphthazole
 $C_4O-C_6-C_6$. Naphthofuran
 $C_4S-C_6-C_6$. Naphthothiophene
 $C_6-C_6N-C_6$. Indenopyridine
 $C_6-C_6-C_6$. Acenaphthylene
 C_6-C_6 . Fluorene
- 6, 6, 6** $C_2N_2-C_2N_2-C_2N_2$. Hexamethylenetetramine
 $C_4AsN-C_6-C_6$. Phenarsazine
 $C_4AsO-C_6-C_6$. Phenoxarsine
 $C_4NO-C_6-C_6$. Isophenoxazine
 $C_4N-C_6-C_6$. Phenoxazine
 $C_4NS-C_6-C_6$. Isophenothiazine
 $C_4N_2-C_2N-C_6$. Pyridoquinazoline
 $C_4N_2-C_6-C_6$. Pyrimidoquinoline
 $C_4N_2-C_6-C_6$. Benzocinnoline
 $C_4N_2-C_6-C_6$. Benzophthalazine
 $C_4N_2-C_6-C_6$. Benzoquinoxaline
 $C_4N_2-C_6-C_6$. Perimidine
 $C_4N_2-C_6-C_6$. Phenazine
 $C_4(O_2-C_6O-C_6O)$. Dipyranodioxin
 $C_4N-C_6N-C_6$. Pyridoquinoline
 $C_6N-C_6-C_6$. Acridine
 $C_6N-C_6-C_6$. Benzisoquinoline
 $C_6N-C_6-C_6$. Benzoquinoline
 $C_6N-C_6-C_6$. Phenanthridine
 $C_6O-C_6O-C_6$. Benzodipyran
 $C_6O-C_6-C_6$. Isoxanthene
 $C_6O-C_6-C_6$. Naphthopyran
 $C_6-C_6-C_6$. Xanthene
 $C_6-C_6-C_6$. Anthracene
 $C_6-C_6-C_6$. Phenanthrene
- 6, 6, 7** $C_6-C_6-C_6N_2$. Anthranilic acid, *N*-(*o*-aminophenyl)-, cyclic amide, 294³, 987⁶
 $C_6-C_6-C_6O$. Dibenzohomopyran*
 $C_6-C_6-C_6$. Diphenide
 $C_6-C_6-C_6S$. *p, p'*-Bitolyl, 3,3'-sulfonyl-(?)*
- 6, 6, 8** $C_4N-C_6N-C_6N_2$. Nicotinic acid, 2-amino-bimolecular cyclic anhydride
6, 6, 11 $C_6N-C_6-C_6N_2OS$. 2-Benzeneazomethylene - 1,2 - dihydro-1 - methylquinoline-4' - sulfonic acid*, inner salt, 289²
- IV**
3, 6, 6, 12 $N_2O-C_6-C_6-C_6N_2$. Stilbene, *p, p'*-azoxy-
4, 5, 5, 5 $C_4-C_2NS-C_6-C_6$. Camphothiazole*
5, 5, 6, 6 $C_2N_2-C_4N-C_6-C_6$. Pseudoisindolobenzimidazole
 $C_2N_2-C_6-C_6N-C_6$. Camphoceanic acid, 3 - (2 - benzimidazolyl)-, cyclic amide
 $C_6-C_6-C_6$. Camphonan acid, 3 - (2 - benzimidazolyl)-, cyclic amide
- $C_4S-C_4S-C_6-C_6$. Anthracene, 9,10-dihydro-9 - phenyl-9,10-thio-
 $C_6-C_6-C_6-C_6$. Fluoranthene
 $C_6-C_6-C_6-C_6$. Indenoindene
5, 6, 6, 6 $C_2N_2-C_6N-C_6-C_6$. Isotriazoloacridine
 $C_2NO-C_6-C_6-C_6$. Phenanthroxazole
 $C_2N_2-C_6-C_6-C_6$. Anthrapyrazole
 $C_4N-C_4N_2-C_6-C_6$. Phenanthrimidazole
 $C_4N-C_4N_2-C_6-C_6$. Indoloquinoxaline
 $C_4N-C_4N_2-C_6-C_6$. Isoindoloquinoxaline
 $C_4N-C_4N_2-C_6-C_6$. Pyrazinocarbazole
 $C_4N-C_4N_2-C_6-C_6$. Indoloquinoline
 $C_4O-C_4N_2-C_6-C_6$. 5 - Iso - 2,3 - γ - indo-quinoline
 $C_4O-C_4N_2-C_6-C_6$. Benzofuroquinoxaline
 $C_4O-C_6-C_6-C_6$. 1-Anthracic acid, 9,10-dihydro-9-hydroxy-, lactone
 $C_6-C_6N-C_6-C_6$. Acenaphthopyridine
 $C_6-C_6N-C_6-C_6$. Indenoquinoline
 $C_6-C_6-C_6-C_6$. Benzofluorene
6, 6, 6, 6 $C_2N_2O-C_6-C_6-C_6$. Anthrisoxdiazine
 $C_4AsN-C_6-C_6-C_6$. Benzophenarsazine
 $C_4AsO-C_6-C_6-C_6$. Benzophenoxarsine
 $C_2NO-C_4NO-C_6-C_6$. Diphenidioxazine*
 $C_4NS-C_6-C_6-C_6$. Isobenzophenothiazine
 $C_2N_2-C_4NO-C_6-C_6$. Diphenazineoxazine*
 $C_2N_2-C_4N_2-C_6-C_6$. Quinoxalokinoxaline
 $C_4N_2-C_4C_2-C_6-C_6$. Diphenazineoxime*
 $C_4N_2-C_6N-C_6-C_6$. Pyrazinoacridine
 $C_4N_2-C_6-C_6-C_6$. Benzophenazine
 $C_6N-C_6N-C_6-C_6$. Dibenzocopyrine
 $C_6N-C_6N-C_6-C_6$. Dibenzokinolinizine
 $C_6O-C_6-C_6-C_6$. Quinoquinoline
 $C_6O-C_6-C_6-C_6$. Anthrapyran
 $C_6-C_6-C_6-C_6$. Benzoxanthene
 $C_6-C_6-C_6-C_6$. Isobenzoxanthene
 $C_6-C_6-C_6-C_6$. Benzanthrene
 $C_6-C_6-C_6-C_6$. Pyrene
 $C_6-C_6-C_6-C_6$. Triphenylene
6, 6, 6, 7 $C_6-C_6-C_6-C_6O$. Thebenol
- V**
4, 5, 5, 6, 6 $C_2N-C_4N-C_4N-C_6-C_6$. Azetodiindole
 $C_4-C_6-C_6-C_6-C_6$. Truxene
5, 5, 6, 6, 6 $C_2O_2-C_4N-C_6N-C_6-C_6$. Isodioxoloquinoline
 $C_2O_2-C_6-C_6N-C_6-C_6$. Dioxoloindenoquinoline
 $C_4N-C_4N-C_6N-C_6-C_6$. Isodioxoloindenoquinoline
 $C_4N-C_4N-C_6N-C_6-C_6$. Diindolopyridine
 $C_6-C_6-C_6-C_6-C_6$. Benzodiindene
5, 6, 6, 6, 6 $C_2N_2-C_4N_2-C_6-C_6-C_6$. Phenanthrene-phenazonium*
 $C_2N_2-C_2N_2-C_6-C_6-C_6$. Indazolophthotriazine
 $C_2N_2-C_6N-C_6-C_6-C_6$. 1,3-Benzodiazole, 1,2(1',8')-naphthoylene-*
 $C_2O_2-C_6N-C_6N-C_6-C_6$. Oxyberberine*
 $C_4N-C_4N-C_6-C_6-C_6$. Acridoline
 $C_4N-C_6-C_6-C_6-C_6$. Naphthocarbazole
 $C_4O-C_4N_2-C_6-C_6-C_6$. Naphthofuroquinoxaline
 $C_6-C_6-C_6-C_6-C_6$. Dibenzofluorene
5, 6, 6, 6, 7 $C_4N-C_6-C_6-C_6-C_6N_2$. 1-Carbazolecarboxylic acid, 9 - (*o* - aminophenyl)-
5, 6, 7, 8 - tetrahydro-, inner anhydride
6, 6, 6, 6, 6 $C_4NO-C_4NO-C_6-C_6-C_6$. Triphenodioxazine

$C_6N_2C_4NO-C_8-C_8-C_8$. Triphenazine-oxazine*

$C_6N_2-C_4N_2-C_8-C_8-C_8$. Fluorindine
 $C_6N_2-C_8-C_8-C_8-C_8$. Dibenzophenazine
 Dibenzophenazonium

$C_6O-C_8-C_8-C_8-C_8$. Dibenzoxanthrene
 $C_8-C_8-C_8-C_8-C_8$. Dibenzanthrene
 Naphthanthrene
 Perylene

VI

5, 6, 6, 6, 6 $C_2N_2-C_4N_2-C_8-C_8-C_8-C_8$. Dibenzotriazolophenazine

$C_8N_2-C_8N-C_8-C_8-C_8-C_8$. 1,3-Naphthimidazole, 1,2(1',8')-naphthylene-*

$C_4N-C_4N_2-C_6N-C_8-C_8-C_8$. 13-Ac-rindolineacetic acid, 1,2,3,4,7,12-hexa-hydro-, inner anhydride

6, 6, 6, 6, 6 $C_4N_2-C_4NO-C_8-C_8-C_8-C_8$. Compd. from 6 - methyl - 3,4 - phenoxazinedione and *N*² - phenyl - 1,2 - naphthylenediamine, 1283⁸

$C_6N_2-C_4N_2-C_8-C_8-C_8-C_8$. Benzo-fluorindine
 $C_4N_2-C_8-C_8-C_8-C_8-C_8$. Tribenzophenazine

$C_8-C_8-C_8-C_8-C_8-C_8$. Trimethylene triphenylmethane triketone⁴

VII

5, 5, 5, 6, 6, 6 $C_4N-C_4N-C_4N-C_4N-C_8-C_8-C_8$.

Triindolopyridine

6, 6, 6, 6, 6, 6 $C_4N_2-C_4N_2-C_8-C_8-C_8-C_8$. Di-benzofluorindine

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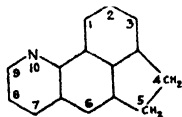
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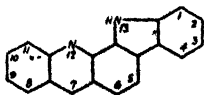
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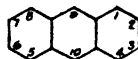
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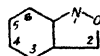
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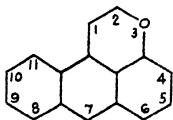
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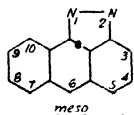
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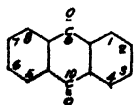
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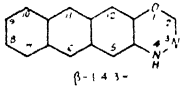
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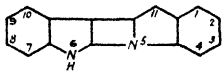
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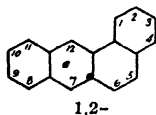
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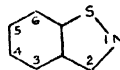
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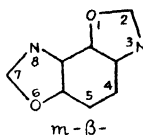
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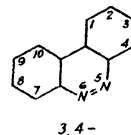


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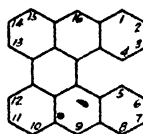
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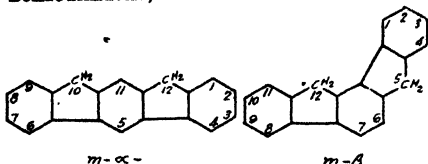
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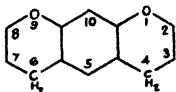
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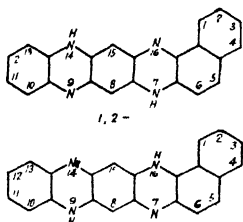
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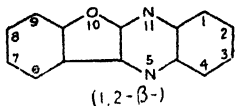
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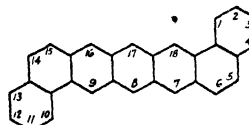
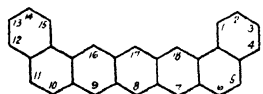
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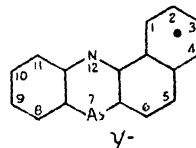
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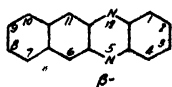
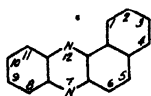


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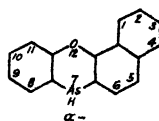
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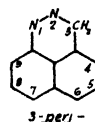
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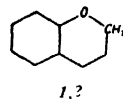
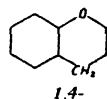
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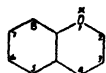
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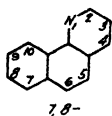
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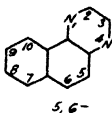
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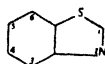
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—, **5' - chloro - 6' - hydroxy - 4 - iodo-,** and *o*-iodobenzoate, 1562⁷.

—, **5' - chloro - 6' - hydroxy - 2 - nitro-,** and *m* (and *p*)-nitrobenzoates, 1562^{a,7}.

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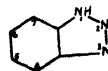
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—, **3,4 - dihydro - 7 - methyl - 3 - p - tolyl-4-p-tolylimino-,** 645^a.

—, **3,4 - dihydro - 3 - phenyl - 4 - phenylimino-,** 645⁷.

1,2,3 - Benzotriazine - 3 - p - benzenearsonic acid, 3,4 - dihydro - 4 - keto-, 979^a.

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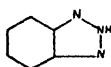


—, **7 - acetamido - 1 - phenyl-,** 282^a.

—, **7 - amino - 1 - phenyl-,** 282^a.

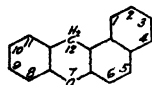
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 —, 2 - (5 - aminosalicyl)-, 514⁴.
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 —, 2 - (2,4 - dihydroxyphenyl)-, 514⁴.
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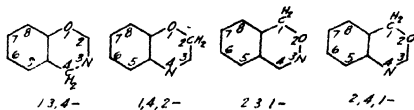
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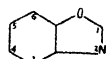
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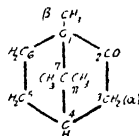
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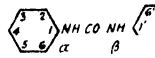
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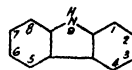
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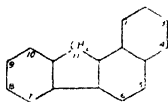
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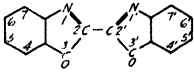
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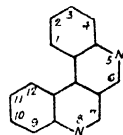
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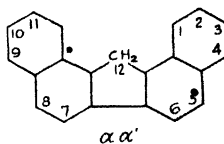
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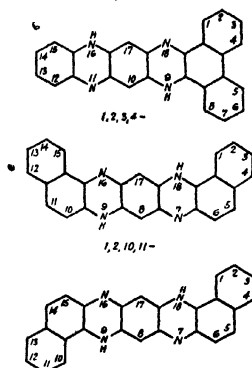
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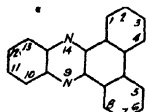
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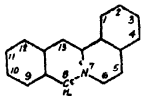
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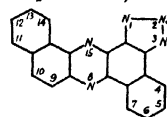
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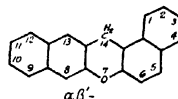


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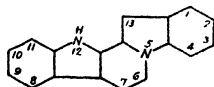
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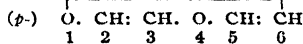
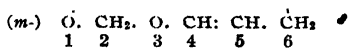
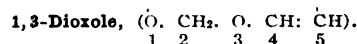
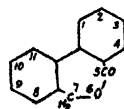
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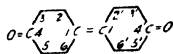
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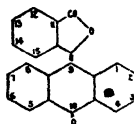
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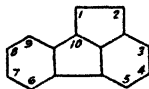
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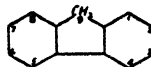
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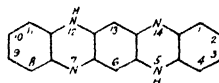
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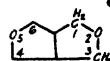
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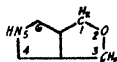


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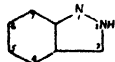
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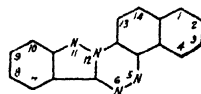
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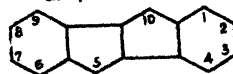
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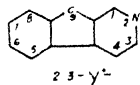
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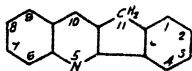
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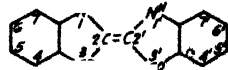


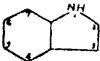
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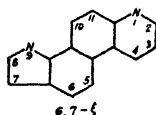
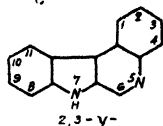
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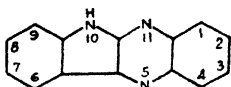
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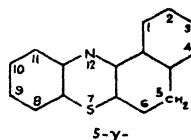
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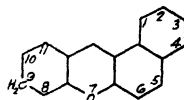


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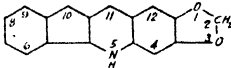
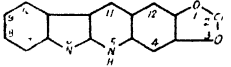
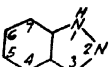
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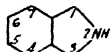
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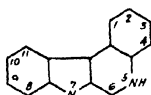


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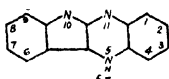
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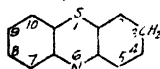
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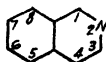
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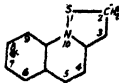
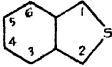
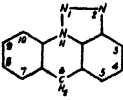
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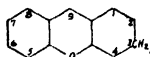
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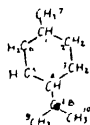
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Naphthalimide, N - (*o*-acetamidophenyl)-, 830⁷.

N - (2-amino-1-naphthyl)-, 830⁸.

N - (*o*-aminophenyl)-, 830⁷.

N - (2-aminotolyl)-, 830⁸.

N - (*o*-benzamidophenyl)-, 830⁷.

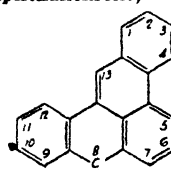
N - (*o*-ethylaminophenyl)-, 830⁷.

Naphthalyl chloride, prepn. of, 497¹.

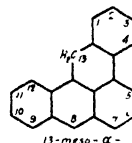
Naphthan. See Decalin.

2 - Naphthanilide, 3-hydroxy-. See "Naphthol AS" under Dyes.

Naphthanthrene,



δ -*meso*- α -



13-*meso*- α -

8 - *meso*- α - Naphthanthrene-10-carboxylic acid, 12,13 - dihydro-8,13-diketo-, 1570⁹.

8 - *meso*- α - Naphthanthren-13-ol, 10-methyl- (?), 1570⁹.

13 - *meso*- α - Naphthanthren-13-ol, 10-methyl- (?), 1570⁹.

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Naphthenic acids, alkali salts of, colloidal properties of, 2898⁷.

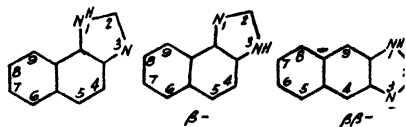
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ketone formation from, 647¹.

from Niitsa oil distillates, 486³.

from petroleum distillate, 1136².
from petroleum of Nishiyama, 3158².
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1,3 - Naphthimidazole, 1,2(1',3') - naphthylene-*, 830⁹.

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4,9 - $\beta\beta$ - Naphthimidazole diol, 2-methyl-1-phenyl-, and diacetate, 2821¹.

4,9 - $\beta\beta$ - Naphthimidazole dione, 2-methyl-1-(2-naphthyl)-, 2821¹.

—, 2-methyl-1-phenyl-, 2820⁹.

Naphthindole. See Naphthazole.

Naphthindolenine. See Pseudonaphthazole.

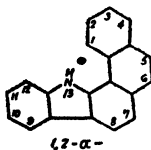
Naphthionic acid, Na salt, surface tension of, variation under influence of radiation, 3395⁹.

—, 3 - [α - (β - hydroxyphenyl)-*p*-tolyl-azo]-, Na salt, 3267⁸.

—, *p,p'* - methylenediphenyldisazo)bis-, ("red dye"), 3267⁷.

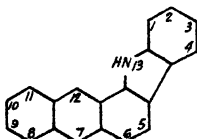
Naphthoaldehyde. See Naphthaldehyde.

1,2- α -Naphthocarbazole,



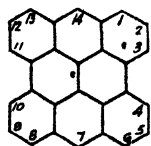
—, 1,2,3,4,7,8-hexahydro-, and picrate, 1273².

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—, 1,2-dibromo-, 2047².

—, 2-isonitro-, sodium deriv., 2046⁹.

—, 2-phenylimino-, 64¹, 2046⁹.

—, 2-*o*-tolylimino-, 64¹.

2(1) - α - Naphthofuranone, 1-phenylimino-, 2047².

—, 1,1,4-tribromo-, 2047².

2(1) - β - Naphthofuranone, 1-allyl-phenyl-, 1277².

—, 1-benzyl-1-phenyl-, 1277¹.

—, 1-ethyl-1-phenyl-, 1277².

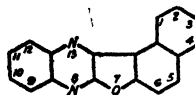
—, 1-methyl-1-phenyl-, 1277².

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—, 1-phenyl-, tautomerism of, 2044¹.

1(2) - β - Naphthofuranone [$\Delta^{2,3}$]oxindole, 2047².

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—, 8-benzoyl-, and Et ester, 497^{2,3}.

—, 5-bromo-, 5' - chloro - 6' - hydroxy-2-naphtho-*m*-toluide ester, 1562².

—, 1,4 (and 3,4)-dihydro-, Et ester, optical properties of, 1269².

—, 7,8 - dihydro - 7,8 - diketo-, 8-phenylhydrazine cyclic hydrazide—see 3-*peri*-Benzophthalazine - 3,9(2) - dione, 2-phenyl-.

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—, 6-amino-, 2820¹.

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—, 4 - (*o* - chlorobenzoyl)-1-hydroxy-, P 300².

—, decahydro-1-hydroxy-, 262¹.

—, decahydro-1-keto-, *trans*-, derivs., 1270⁴.

—, 1,2(1,4 and 3,4)-dihydro-, Et ester, optical properties of, 1269².

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—, 3,4-dihydro-1-methyl-, and Et ester, 1269².

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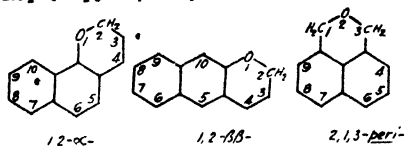
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 —, **6(and 7)-bromo-**, 987^o.
 —, **5-bromo-2-methyl-**, 2487^o.
 —, **4-(p-chloroanilino)-**, 2493^o.
 —, **4-(4-chloro-2,5-xylylazo)-**, 255^o.
 —, **decahydro-**, *cis-* and *trans-*, 1270^o.
 —, **2,4-dichloro-**, 827^o.
 —, **2,3-diphenyl-**, and acetate, 2660^o.
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 —, **4-(o-nitrophenylazo)-**, 515^o.
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 —, **7-acetamido-5,6,7,8-tetrahydrodinitro-**, acetate, 497^o.
 —, **7-acetamido-5,6,7,8-tetrahydronitro-**, acetate, 497^o.
 —, **7-amino-1,3-dibromo-5,6,7,8-tetrahydro-**, and -HBr, 497^o.
 —, **1-amino-6-methyl-**, 2819^o.
 —, **7-amino-1,2,3,4-tetrahydro-**, and derivs., 497^o.
 —, **7-amino-5,6,7,8-tetrahydro-**, and derivs., 497^o.
 —, **7-amino-5,6,7,8-tetrahydrodinitro-**, and salts, 497^o.
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 —, **1-anilino-**, sulfonation of, 2662^o.
 —, **7-benzamido-5,6,7,8-tetrahydro-**, benzoate, 497^o.
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 —, **1-(8-quinolyloxy)-**, 1280^o.
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—, 2-(*N*-acetylanilino)-3-amino-†, 2820⁹.

—, 2-(*N*-acetylanilino)-3-anilino-†, 2820⁹.

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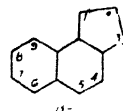
1,2-Naphthoquinone-4-4-thiosulfonic acid*, and K salt, 514¹.

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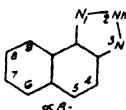
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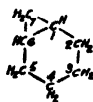
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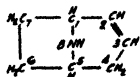
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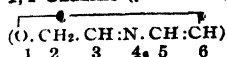
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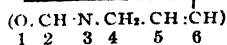
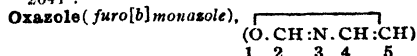
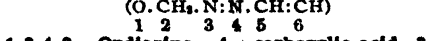
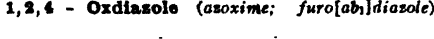
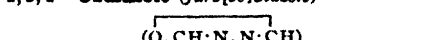
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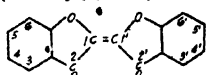
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
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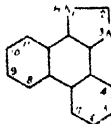
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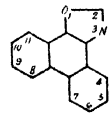
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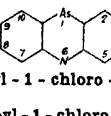
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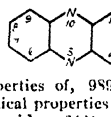
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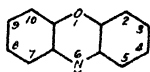
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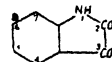
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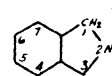
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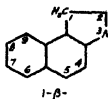
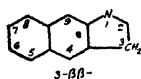
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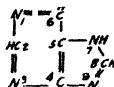


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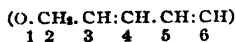
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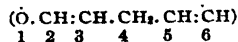
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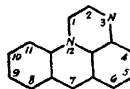
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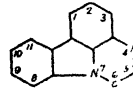
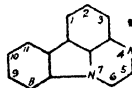
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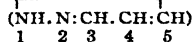
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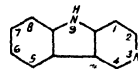
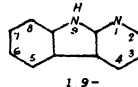
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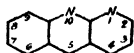
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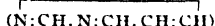
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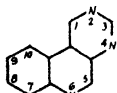


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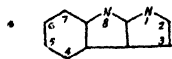
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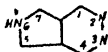
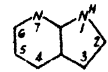
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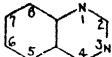
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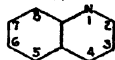
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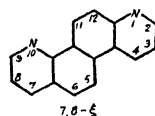
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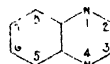


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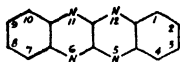
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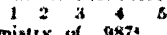
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Triazete (N:N:N:CH)

1 2 3 4

—, tetrahydro-. See *Triazetidine*.

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1263¹.

as-Triazine (N:N:CH:N:CH:CH)

1 2 3 4 5 6

—, 4 - *p*-anisyl - 3 - (*p*-chlorophenyl) -
2,3,4,5 - tetrahydro - 6 - phenyl - 2 - *o*-
tolyl-, 478¹.

—, 4 - *p*-anisyl - 3 - (*p*-dimethylamino-
phenyl) - 2,3,4,5 - tetrahydro - 6 -
phenyl - 2 - *o*-tolyl-, 478¹.

—, 4 - *p*-anisyl - 2,3,4,5 - tetrahydro -
3,6-diphenyl - 2 - tolyl-, 478¹.

—, 4 - *p*-anisyl - 2,3,4,5 - tetrahydro - 3 -
methyl-6-phenyl-2-*o*-tolyl-, 478¹.

—, 4 - *p*-anisyl - 2,3,4,5 - tetrahydro - 6 -
phenyl - 2 - *o*-tolyl-, 478¹.

—, 3,4-di-*p*-anisyl - 2,3,4,5 - tetrahydro-
6-phenyl-2-*o*-tolyl-, 478¹.

s-Triazine (N:CH:N:CH:N:CH)

1 2 3 4 5 6

—, hexahydro-1,2,5-trimethyl-, deriva.,
538¹.

—, 1,2,5-triethylhexahydro-, deriva., 538¹.

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at-Triazine 6 - α - adipic acid, 2,2,4,5-
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1559¹.

Triazinobenzimidazole



4 - Triazinobenzimidazolemercaptan, 1,2 -
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Triazole acid. See *Hydrazic acid*.

1,2,3-Triazole (pyro[ab]diazole)

(NH.N:N.CH:CH)

1 2 3 4 5

—, 5 - (*N*-acetylanilino) - 4 - phenyl - 1 -
p-tolyl-, 988¹.

—, 5 - (*N*-acetyl - *p*-toluino) - 1,4 -
diphenyl-, 988¹.

—, 5 - anilino - 4 - phenyl - 1 - *p*-tolyl -,
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—, 1,1' - *p*-biphenylenebis-, 476¹.

—, 1,1' - *p*-biphenylenebis[5-methyl-,
477¹.

—, 5 - chloro - 4 - phenyl - 1 - *p*-tolyl-,
987¹.

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—, 1 - (3,4-dibromophenyl)-5-methyl-,
477¹.

—, 1-(3,4-dichlorophenyl)-, 476¹.

—, 1-(3,5-dichlorophenyl)-, 476¹.

—, 1-(3,4-dichlorophenyl)-5-methyl-,
477¹.

—, 1-(3,5-dichlorophenyl)-5-methyl-,
477¹.

—, 1,4-diphenyl - 5 - *p*-toluino-, ni-
trite, and dinitro deriv., 988¹.

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—, 3,5-iminodihydro-, 987¹.

—, 4-isopropyl-1-phenyl-, 2341¹.

—, 4-methyl-1-phenyl-, 2341¹.

—, 5 - *N*-nitrosoanilino - 4 - phenyl - 1 -
p-tolyl-, 988¹.

—, 5 - (*N*-nitroso - *p*-toluino) - 1,4 -
diphenyl-, 988¹.

—, 1-phenyl-, prepn. of, 2340¹.

—, 1-*o*-tolyl-, 476¹.

1,2,4-Triazole (pyro[ab]diazole)

(NH.N:CH.N:CH)

1 2 3 4 5

—, 3-benzylmercapto - 1,5-diphenyl -,
2053¹.

—, dihydro-. See *1,2,4-Triazoline*.

—, tetrahydroadiketo-. See *Urazole*.

1,2,5-Triazole (pyro[aa]diazole)

(NH.N:CH.CH:N)

1 2 3 4 5

—, 1,3-diphenyl-, 2954¹.

—, 3-methyl-4-(*o*-nitrophenyl)-1-
phenyl-, 2938¹.

1,3,4-Triazole (pyro[bb]diazole)

(NH.CH.N:N:CH)

1 2 3 4 5

—, 3-(benzylmercapto) - 1,5-diphenyl-,
2053¹.

—, 2,2'-dithiolbis[5-*o*-toluino-1-*o*-
tolyl-, 2495¹.

1,2,5-Triazole - 3 - *o*-benzamide, 4 - car-
bamyl-1-phenyl-, 1865¹.

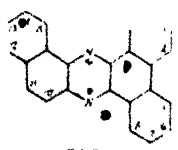
1,2,5-Triazole - 3 - benzoic acid, 4 - car-
boxy-1-phenyl-, 2954¹.

1,2,5-Triazole - 3 - *o*-benzoic acid, 1 - (*p*-
bromophenyl)-4-carboxy-, and mono
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—, 4-carbamyl-1-phenyl-(7), ammonium
salt, 1865¹.

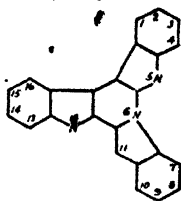
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—, 4-carboxy-1-phenyl-, and deriva.
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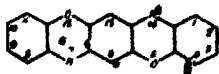
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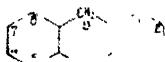
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III. FORMULA INDEX

KEY.

In using this index the following should be borne in mind:

1. The Formula Index is **supplementary** to the Subject Index. In no sense does it replace any part of the latter except that some of the organic compounds that were not named in the original papers are entered in the former only.
2. **Inorganic as well as organic compounds** have been entered.
3. **Entries under their own formulas** are made for all strictly inorganic and strictly organic compounds and for the true organic derivatives of organic compounds, both addition compounds and true reaction derivatives (this includes esters, hydrazones, methohalides, oximes, picrates, semicarbazones, etc.). Inorganic salts of organic acids and inorganic addition compounds of organic compounds (hydrohalides, chloroplatinates, perchlorates, sulfates, etc.) are not given separate entries but are indicated in modifying phrases under the formulas of the compounds from which they are derived (under the acid in the case of a salt), unless the exact nature of the compound is uncertain, when an entry is made under its own formula. Salts of formic, acetic and oxalic acids are exceptions; these are entered as such.
4. The **arrangement of symbols in formulas** is alphabetical except that in carbon compounds C always comes first, followed immediately by H if hydrogen is also present.
5. The **arrangement of formulas** is also alphabetical except that the number of atoms of any specific kind influences the order of compounds. E. g., all formulas with 1 C come before those with C₂, thus: CCl₂O₂, CCl₄, CHCl₃, CHN, CHNO, CH₂Br₂, CH₂O, CH₂Cl, CO, C₂Ca, C₂H₄O₂.
6. The **arrangement of entries under any heading** is strictly alphabetical according to the preferred names of the isomers.
7. **Entries consist of** (a) the formula (in bold-face type), (b) the name as it has been entered in the Subject Index (in light-face Roman type; *it should be noted particularly that the part of the entry in this type is the exact equivalent of the formula given*), (c) occasionally a modifying phrase or word such as "Ca salt" or "hydrochloride" (in italics, different type being used to set off that part of a compound being indexed which is not represented in the formula used; see ¶ 3 above), (d) the page reference, and (e) the fraction of the page in ninths (indicated by a small superior numeral) in which the compound will be found.
8. **Cross-references** are to the Subject Index.

9. Water of hydration is not made a part of the formulas indexed but is usually given in light-face type following the formulas.

10. Polymers having different names and recognized as different substances, e. g., acetaldehyde and paraldehyde, are all entered under their accepted formulas. But definite compounds for which different polymeric formulas are in use are entered under the simplest formulas only with cross-references under the polymeric formulas.

11. A straight line, thus —, used under some headings to avoid repetition of names, always stands for the name of the "index compound," i. e., that part of the preceding name (inverted) which comes before the comma.

12. "P" before a page number indicates that the abstract is of a patent.

13. The names beryllium (Be) and columbium (Cb) are given preference over glucinum (Gl) and niobium (Nb), respectively, for these elements.

The Key to a formula index is necessarily lengthy. It would not be correct to conclude from this that this index is difficult to use. Experience is to the contrary.

INTRODUCTION.

General purpose and policy. The location of chemical compounds in an index by names is at times uncertain because names vary and in the case of complex compounds may be difficult to ascertain. New compounds are constantly being prepared, which if named at all, may receive more than one name which is justified from one point of view or another and the possibilities of incorrect names are great. Since the kind and number of component atoms of a chemical compound are unvarying characteristics the supplementary Formula Index to *Chemical Abstracts* is published for the purpose of eliminating this element of uncertainty in the Subject Index. Except that many unnamed compounds are no longer entered under the heading "Compound," the Subject Index is in no way altered on account of the Formula Index. In the Subject Index related compounds are *grouped* rather effectively and to good use by the present system of indexing on the basis of "parent compounds" or, more accurately, "index compounds;" in the Formula Index the certain location of *individual* compounds is the primary consideration. The Subject Index is more convenient to use in some respects and it frequently contains more information in the form of modifying phrases. The repetition of modifying phrases in the Formula Index beyond necessary brief phrases to indicate derivatives has been avoided as unnecessary for the accomplishment of the real purpose of this index, as stated above, and as inconsistent with necessary economy. Isomerism is not indicated in the Formula Index in cases in which the names differ only in position numbers or letters but it always is in the Subject Index when known. Ready reference to the Subject Index for the purpose of locating information regarding related compounds is made possible by the use in the Formula Index of names following the formulas written exactly as they appear in the former index.

All new compounds and all compounds for which new data are given have been entered. Most of the compounds have been entered under their own formulas. Some departure from a policy of making separate formula entries for derivatives of all kinds is reasonable and accords with custom. The only departures in this index, (see ¶ 3

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- BrKO₂** See *Potassium bromate*.
BrNO₂ Nitryl bromide, 1245⁷.
BrN₂ Hydrazoic acid, bromo-, 1106⁸.
BrNa See *Sodium bromide*.
BrNaO See *Sodium hypobromite*.
BrEba See *Rubidium bromide*.
BrTI See *Thallium bromide*.
BrCa See *Calcium bromide*.
BrCs Cesium dibromiodide, 21.
BrCo See *Cobalt bromide*.
BrCo₂H₂N₁₀O₈, 3070⁸.
BrCu See *Copper bromide*.
BrCu₂ See *Copper bromides*.
BrFe See *Iron bromides*.
BrFeH₁₁N₆, 1232⁷.
BrH₂O₂Se, 2460⁴.
BrHg See *Mercury bromides*.
BrHg₂O, 2308⁸.
BrHg₂O₄, 2308⁸.
BrOS See *Thionyl bromide*.
BrPb See *Lead bromides*.
BrSe₂ See *Selenium bromide*.
BrZn See *Zinc bromide*.
BrCl₂TI₄, 788⁴.
BrCoH₂N₁₀O₈, 3070⁸.
BrH₂O₂Si Siloxene, tribromo-, 19³, 618⁸.
BrP See *Phosphorus bromide*.
BrSb See *Antimony bromide*.
BrYt See *Yttrium bromide*.
BrCdCl₂ Cadmium chloroperbromide, 598⁸.
BrClHg Mercury chloroperbromide, 598⁸.
BrCl₂H₂OW₂ + 9H₂O Bromochlorotungstic acid, 618⁴.
BrCo₂H₂N₁₀O₈Se, 617³.
BrH₂STI, 3226³.
BrH₂O₂Se, 2460⁴.
BrH₂S₂TI, 3226³.
BrHf See *Hafnium bromide*.
BrHg₂N₂O₆, 787⁷.
BrHg₂O₂S, 787⁸.
BrSn See *Tin bromide*.
BrTI See *Titanium bromide*.
BrTI₂, 788⁴.
BrZr See *Zirconium bromide*.
BrHgK Potassium bromomercurate, 1978⁴.
BrH₂N₂Pt, 940⁸.
BrH₂N₂Se, 940⁸.
BrH₂N₂Sn, 940⁸.
BrMo₂ See *Molybdenum bromides*.
BrO₂Si Siloxene, hexabromo-, 19³, 618⁸.
BrTI₂, 788⁴.
CAg₂O₂ See *Silver carbonate*.
CBaO₂ See *Barium carbonate*.
CBrKN₂O Methane, bromodinitro-, K deriv., 1400⁹.
CBrN See *Cyanogen bromide*.
CBrN₂O₂ Nitroform, bromo-, 1261⁴.
CBr See *Carbon tetrabromide*.
CCaN₂ See *Calcium cyanamide*.
CCaO₂ See *Calcite*; *Calcium carbonate*; *Vaterite*.
CCb See *Columbium carbide*.
CCDO₂ See *Cadmium carbonate*.
CCIN See *Cyanogen chloride*.
CCIN₂O Methane, chlorotrigitro-, 2188⁸.
CCl₂N₂O₂ Methane, dichlorodinitro-, 2189⁸.
CCl₂O See *Phosgene*.
CCl₂NO₂ See *Chloropicrin*.
CCl₄ See *Carbon tetrachloride*.
CCr₂ See *Chromium carbide*.
CCuN See *Copper cyanides*.
CCuNS See *Copper thiocyanate*.
CCuO₂ See *Copper carbonate*.
CFeO₂ See *Iron carbonates*; *Siderite*.
CF₂ See *Cementite*; *Peashite*.
CHBrN₂O Methane, bromodinitro-, 2027⁸.
CHBr₂ See *Bromoform*.
CHBr₂O Bromal, 2807⁷.
CHCl₂ See *Chloroform*.
CHI₂ See *Iodoform*.
CHN See *Hydrocyanic acid*.
CHNO (See also *Cyanic acid*.)
 Fulminic acid, 2807⁷.
CHNS See *Thiocyanic acid*.
CHNaO₂ See *Sodium formate*.
CHNaO₃ See *Sodium carbonates*.
CH₂BrClO₂S Methanesulfonic acid, bromo-chloro-, and NH₄ salt, 2927⁴.
CH₂BrNO₂ Methane, bromonitro-, 481⁸.
CH₂Cl₂ See *Methane, dichloro-*.
CH₂Cl₂Te₂ Telluritrichloride, methylenebis-, 1696⁷.
CH₂Cu₂O₂ See *Malachite*.
CH₂Mg₂O₂ + 3H₂O See *Artinite*.
CH₂N₂ (See also *Cyanamide*.)
 Methane, diazo-, 260¹, 2041¹.
CH₂O See *Formaldehyde*.
(CH₂O)_x See *Paraformaldehyde*.
CH₂O₂ See *Formic acid*.
CH₂O₂ (See also *Carbonic acid*.)
 Performic acid, 924².
CH₂Te₂ Methane, ditelluro-, 1696⁷.
CHBr See *Methane, bromo-*.
CHBrMg Methylmagnesium bromide, 2817³.
CH₂Cl See *Methane, chloro-*.
CHI See *Methane, iodo-*.
CHIMg Methylmagnesium iodide, 2656⁸.
CHNO Formhydroxamic acid, 3221³.
CH₂NO₂ Carbamic acid, 925¹, 1523⁸.
 Methane, nitro-, 261¹, 1515⁸.
CH₂NS₂ Carbamic acid, dithio-, salts, P 2210⁸.
CH₂NaO Sodium methoxide, 487⁷, 3482⁸.
CH₂NaO₂S See *Sodium formaldehydesulfoxylate*.
CH₂Na₂O₂P, 2178¹.
CHI See *Methane*.
CHBr₂CdN₂O, 20⁸.
CH₂CdCl₂N₂O, 20⁸.
CH₂Cl₂N₂O, 20⁸.
CH₂HgS Methylmercuric mercaptan, 465⁴.
CH₂N₂O See *Ammonium cyanate*; *Urea*.
CH₂NS₂ See *Ammonium thiocyanate*; *Urea*, thio-.
CH₂N₂O₂ Guanidine, nitro-, 1559¹.
CH₂NS₂ 1,2,3,4 - Tetrazole, tetrahydrothio-, 2206⁴.
CH₂O See *Methanol*.
CH₂O₂Sn Methanestaunonic acid, 465¹, 3227⁴.
CH₂O₂S Formaldehydesulfoxylic acid, 237⁸.
CH₂S Methyl mercaptan, 38¹.
CH₂N See *Methylamine*.
CH₂NO₂ See *Ammonium carbonates*.
CH₂N₂ See *Guanidine*.
CH₂N₂O See *Semicarbazide*.
CH₂NS Semicarbazide, thio-, 831⁴, 2953⁸.
CH₂LN Methylammonium triiodide, 1403⁴.
CH₂N₂ Hydrazine, methyl-, 1864⁴.
CH₂N₂O Carbohydrazide, 245⁸.
CH₂N₂S Carbohydrazide, thio-, 2206⁸.
CH₂N₂O₂ See *Ammonium carbonate*.
CH₂CoN₂O₂SSe + 2H₂O, 617⁸.
CI See *Carbon tetraiodide*.
CKN See *Potassium cyanide*.
CKNO See *Potassium cyanate*.
CKNS See *Potassium thiocyanate*.
CK₂O₂ See *Potassium carbonates*.
CMgO₂ See *Langfordite*; *Magnesite*; *Magnesium carbonate*; *Nesquehonite*.

- CMnO_2 See *Manganese carbonate; Rhodochrosite.*
 CMo See *Molybdenum carbides.*
 CMo_2 See *Molybdenum carbides.*
 CNNa See *Sodium cyanide.*
 CNNa_2 See *Sodium thiocyanate.*
 CN_2O Methane, tetranitro-, 3373⁹.
 CN_2O Carbonyl azide, 245¹.
 CN_2O_2 See *Sodium carbonate.*
 $\text{CN}_2\text{O}_2\text{H}_2$, 769¹.
 CNiO_2 See *Nickel carbonate.*
 CO See *Carbon monoxide.*
 COS See *Carbonyl sulfide.*
 CO_2 See *Carbon dioxide.*
 CO_2Pb See *Lead carbonate.*
 CO_2Sr See *Strontium carbonate.*
 CO_2Zn See *Calamine; Smithsonite; Zinc carbonate.*
 CS_2 See *Carbon disulfide.*
 CSi See *Silicon carbide.*
 CTa See *Tantalum carbide.*
 CTi See *Titanium carbide.*
 CV See *Vanadium carbide.*
 CW See *Tungsten carbides.*
 CW_2 See *Tungsten carbides.*
 CZr See *Zirconium carbide.*
 C_2AgKN Potassium silver cyanide, 2906¹.
 C_2Ag Silver acetylide, 2631¹.
 $\text{C}_2\text{Al}_2\text{CaCl}_2\text{O}_2$, 2920¹.
 C_2AuKN Potassium auricyanide, 2906¹.
 C_2Ba_2 See *Barium cyanide.*
 C_2Br_2 Ethane, hexabromo-, 1402¹.
 C_2Ca See *Calcium carbide.*
 $\text{C}_2\text{CaH}_2\text{O}_2$ See *Calcium carbonates.*
 C_2CaN See *Calcium cyanide.*
 C_2CaN_2 See *Calcium thiocyanate.*
 C_2CaO See *Calcium oxalate; Whewellite.*
 $\text{C}_2\text{Cl}_2\text{IrO}_2 + \text{H}_2\text{O}$, 942¹.
 $\text{C}_2\text{Cl}_2\text{O}_2$ Oxalyl chloride, 64¹, 280¹, 1245¹.
 C_2Cl_2 See *Ethylene, tetrachloro.*
 C_2Cl_2 Ethane, hexachloro-, 2109¹.
 C_2Cu Copper acetylide, 2467¹, 2631¹.
 $\text{C}_2\text{Cu}_2\text{N}_2$ See *Copper cyanide.*
 C_2FeO See *Iron oxalate.*
 C_2HBrCl Ethylene, bromodichloro-, 1556¹.
 C_2HBrCl_2 Ethane, 1,2,2-tribromo-1,1-dichloro-, 1556¹.
 $\text{C}_2\text{HCO}_2\text{Br} + \text{H}_2\text{O}$ See *Ancyle.*
 $\text{C}_2\text{HClK}_2\text{O}_2 + 3\text{H}_2\text{O}$ Potassium chlorosulfate, 3044¹.
 C_2HCl_2 See *Ethylene, trichloro.*
 $\text{C}_2\text{HCl}_2\text{O}$ See *Chloral.*
 $\text{C}_2\text{HCl}_2\text{O}_2$ See *Acetic acid, trichloro.*
 C_2HCl_2 See *Ethane, pentachloro.*
 $\text{C}_2\text{HKO}_2 + 2\text{H}_2\text{O}$ See *Potassium oxalates.*
 $\text{C}_2\text{HN}_2 + \text{H}_2\text{O}$ Dicyanamide, 3227¹.
 C_2HN_2 , 1,2,3,4-Tetrazole-5-nitrile, 1277¹.
 C_2H_2 See *Acetylene.*
 $\text{C}_2\text{H}_2\text{AsBr}_2\text{Cl}$ Arsenic, dibromo(β -chlorovinyl)-, 3250¹.
 $\text{C}_2\text{H}_2\text{AsBr}_2$ Arsenic, dibromo(β -bromovinyl)-, 3250¹.
 $\text{C}_2\text{H}_2\text{AsCl}_2$ Arsenic, (β -chlorovinyl)diodo-, 3250¹.
 $\text{C}_2\text{H}_2\text{AsClO}$ Arsenious oxide, (β -chlorovinyl)-, 3250¹.
 $\text{C}_2\text{H}_2\text{AsClS}$ Arsenious sulfide, (β -chlorovinyl)-, 3250¹.
 $\text{C}_2\text{H}_2\text{Br}_2\text{KNO}_2$ Ethanol, 2-bromo-2-nitro-, K salt, 1406¹.
 $\text{C}_2\text{H}_2\text{Br}_2\text{Cl}_2$ Ethane, 1,2-dibromo-1,1-dichloro-, 1556¹.
 $\text{C}_2\text{H}_2\text{Br}_2$ Ethane, s-tetrabromo-, 3248¹.
 $\text{C}_2\text{H}_2\text{CaO}_2$ Calcium formate, 2892¹.
 $\text{C}_2\text{H}_2\text{CaO}_2$ See *Calcium carbonates.*
 $\text{C}_2\text{H}_2\text{ClMnNa}_2\text{O}_2$ Ethanol, 2-chloro-1-nitro-, Na salt, 1407¹.
 $\text{C}_2\text{H}_2\text{Cl}_2$ See *Ethylene, dichloro.*
 $\text{C}_2\text{H}_2\text{Cl}_2\text{O}_2$ Acetic acid, dichloro-, 1557¹, 3082¹.
 Na salt , 1520¹.
 $\text{C}_2\text{H}_2\text{Cl}_2$ See *Ethane, tetrachloro.*
 $\text{C}_2\text{H}_2\text{CrO}_4 + 1/2\text{H}_2\text{O}$ Chromium formate, 3071¹.
 $\text{C}_2\text{H}_2\text{CuSO}_2$ See *Asurite.*
 $\text{C}_2\text{H}_2\text{I}_2$ See *Ethylene, s-diiodo.*
 $\text{C}_2\text{H}_2\text{N}_2\text{O}_2$ Acetic acid, diazo-, 2812¹.
 $\text{C}_2\text{H}_2\text{N}_2\text{O}$ Bicarbonyl azide, 245¹.
 $\text{C}_2\text{H}_2\text{O}$ See *Ketene.*
 $\text{C}_2\text{H}_2\text{O}_2$ Glyoxal, 242¹.
 $\text{C}_2\text{H}_2\text{O}_2$ Glyoxylic acid, 945¹, 3479¹.
 $\text{C}_2\text{H}_2\text{O}_2$ See *Oxalic acid.*
 $\text{C}_2\text{H}_2\text{O}_2\text{U} + \text{H}_2\text{O}$ Uranyl formate, 1098¹, 1537¹.
 $\text{C}_2\text{H}_2\text{BrClNO}_2$ Ethanol, 2-bromo-2-chloro-2-nitro-, 1406¹.
 $\text{C}_2\text{H}_2\text{BrO}$ Acetyl bromide, 1693¹, 2640¹.
 $\text{C}_2\text{H}_2\text{BrO}_2$ Acetic acid, bromo-, 2077¹, 3527¹.
 $\text{C}_2\text{H}_2\text{BrO}_2\text{S}$ Acetic acid, bromosulfo-, 2637¹.
 $\text{C}_2\text{H}_2\text{Br}_2\text{NCO}$ Ethanol, 2,2-dibromo-2-nitro-, 1406¹.
 $\text{C}_2\text{H}_2\text{Br}_2\text{O}$ Ethanol, tribromo-, 1431¹.
 $\text{C}_2\text{H}_2\text{Cl}$ Ethylene, chloro-, P 2210¹.
 $\text{C}_2\text{H}_2\text{ClO}$ See *Acetylchloride.*
 $\text{C}_2\text{H}_2\text{ClO}_2$ (See also *Acetic acid, chloro.*)
 $\text{Formic acid, chloro-, Me ester}$, 251¹.
 $\text{C}_2\text{H}_2\text{ClO}_2\text{S}$ Methanesulfonic acid, chloroformyl-, salts, 2323¹.
 $\text{C}_2\text{H}_2\text{ClO}_2\text{S}$ Acetic acid, chlorosulfo-, and NH_4 salt, 1128¹.
 $\text{C}_2\text{H}_2\text{Cl}_2$ See *Ethane, trichloro.*
 $\text{C}_2\text{H}_2\text{Cl}_2\text{O}$ See *Chloral hydrate.*
 $\text{C}_2\text{H}_2\text{I}_2\text{O}$ Acetic acid, iodo-, 1360¹.
 $\text{C}_2\text{H}_2\text{KO}$ See *Potassium acetate.*
 $\text{C}_2\text{H}_2\text{LiO}$ See *Lithium acetate.*
 $\text{C}_2\text{H}_2\text{N}$ Acetonitrile, 3248¹.
 $\text{C}_2\text{H}_2\text{N}_2\text{O}$ 4-Triazetidinecarboxylic acid, 4,2-inner anhydride, 285¹.
 $1,3,4$ -Triazol-2-ol, 285¹.
 $\text{C}_2\text{H}_2\text{N}_2\text{S}$ Urazole, dithio-, 988¹.
 $\text{C}_2\text{H}_2\text{NaO}_2$ See *Sodium acetate.*
 C_2H_2 See *Ethylene.*
 $\text{C}_2\text{H}_2\text{AsBrO}_2$ Ethylenearsonic acid, β -bromo-, 3250¹.
 $\text{C}_2\text{H}_2\text{AsClO}$ Ethylenearsonic acid, β -chloro-, and di-Ag salt, 3250¹.
 $\text{C}_2\text{H}_2\text{Br}_2$ See *Ethane, dibromo.*
 $\text{C}_2\text{H}_2\text{Cl}_2$ See *Ethane, dichloro.*
 $\text{C}_2\text{H}_2\text{Cl}_2\text{O}$ Ether, bis(chloromethyl), 1137¹.
 $\text{C}_2\text{H}_2\text{Cl}_2\text{NO}$ Chloralamide, 2088¹.
 $\text{C}_2\text{H}_2\text{HgO}_2$ Methylmercuric bicarbonate, 465¹.
 $\text{C}_2\text{H}_2\text{N}_2$ (See also *Guanidine, cyano.*)
 $1,2,3$ -Triazole, 2,5-iminodihydro-, 987¹.
 $\text{C}_2\text{H}_2\text{N}_2\text{O}$ 1,2,3,4-Tetrazole, 5-methoxy-, 515¹.
 $\text{C}_2\text{H}_2\text{N}_2\text{OS}$ Urazole, 4-aminothio-, 2206¹.
 $\text{C}_2\text{H}_2\text{N}_2\text{S}$ p-Urazine, dithio-, 2206¹.
 $\text{Urazole, 4-aminodithio-, 2206¹.$
 $\text{C}_2\text{H}_2\text{N}_2\text{O}$ (See also *Acetaldehyde.*)
 $\text{Ethylene oxide, 540¹, 2037¹. MgPrOH compd., 2324¹.$
 $\text{C}_2\text{H}_2\text{O}_2$ (See also *Acetic acid; "methyl ester" under Formic acid.*)
 $\text{Glycolaldehyde, 242¹.$
 $\text{C}_2\text{H}_2\text{O}_2\text{S}$ Acetic acid, mercapto-, 3566¹.
 $\text{C}_2\text{H}_2\text{O}_2$ Glyoxylic acid, 945¹.
 $\text{C}_2\text{H}_2\text{O}_2\text{S}$ Acetic acid, sulfo-, salts, 1096¹.
 $\text{C}_2\text{H}_2\text{AsO}_2$ Acetic acid, arseno-, and derivs., 26¹, 1168¹.
 $\text{C}_2\text{H}_2\text{Br}$ See *Ethant, bromo.*
 $\text{C}_2\text{H}_2\text{BrMg}$ Ethylmagnesium bromide, 2636¹, 2817¹.

C₂H₅Cl See *Ethane, chloro-*.

C₂H₅ClHg Ethylmercuric chloride, 787¹.

C₂H₅ClMgO Ethoxymagnesium chloride, 3251⁴.

C₂H₅ClO Ethanol, 2-chloro-, 970⁴.

Ethyl hypochlorite, 2031¹, 2807¹.

C₂H₅I See *Ethane, iodo-*.

C₂H₅KO Potassium ethoxide, 248⁴.

C₂H₅NO See *Acetamide-*.

C₂H₅NO₂ (See also *Glycine-*)

Glycolamide, 470¹.

C₂H₅NO₂ Glycolhydroxamic acid, 240¹.

C₂H₅NO₂S Ethanesulfonic acid, β - amino - β

keto-, and salts, 237¹.

C₂H₅NS Acetamide, thio-, 3087¹.

Acetimidic acid, thio-, 2470¹.

C₂H₅NaO See *Sodium ethoxide-*.

C₂H₅NaO₂S Ethyl sodium sulfoxylate, 2920².

C₂H₅ See *Ethane-*.

C₂H₅ClO₂N₂, 3071¹.

C₂H₅Cl₂Sn Stannane, dichlorodimethyl-, 3250⁴.

C₂H₅FTl Dimethylthallic fluoride, 1232¹.

C₂H₅FeN₂S₂, 448¹.

C₂H₅HgS Ethylmercuric mercaptan, 465¹.

C₂H₅Li₂OS₂, 619¹.

C₂H₅MgO₂ Magnesium methoxide, 2807¹.

C₂H₅N₂ Azomethane, CuCl₂ addn. compd., 2499¹.

C₂H₅N₂O Urea, methyl-, 754¹.

C₂H₅N₂O Urea, guanyl-, sulfate, 555¹.

C₂H₅Na₂Sn Stannane, dimethyl-, di Na deriv.,

3250⁴.

C₂H₅O See *Ethyl alcohol; Methyl ether-*.

C₂H₅OS Ethanol, 2-mercapto-, 1557¹.

C₂H₅O₂ See *Glycol-*.

C₂H₅O₂S Carbinol, dithiobis-, 237¹.

C₂H₅O₂Sn Ethanestannonic acid, 3227¹.

C₂H₅O₂S See *Ethylsulfuric acid; Methyl sulfate-*.

C₂H₅S Ethyl mercaptan, 351, 3477¹.

Methyl sulfide, 351, 3489¹.

C₂H₅AsO₂ See *Cacodylic acid-*.

C₂H₅N (See also *Ethylamine-*)

Dimethylamine, 1362¹.

C₂H₅NO Acetaldehyde-ammonia, 754¹, 1071¹.

C₂H₅NO₂ See *Ammonium acetate-*.

C₂H₅NO₂ Acetic acid, thio-, NH₂OH salt,

2928¹.

C₂H₅NO₂S Taurine, 2808¹.

C₂H₅NO₂ Glycolic acid, NH₂OH salt, 2928¹.

C₂H₅N₂ See *Guanidine, methyl-*.

C₂H₅N₂S Carbohydrazide, thio-α-thiocarbamyl-,

2260⁴.

C₂H₅Br₂CdN₂O₂, 20¹.

C₂H₅CdCl₂N₂O₂, 20¹.

C₂H₅CdI₂N₂O₂, 21¹.

C₂H₅N₂ Ethylenediamine, 3250¹.

C₂H₅N₂O₂, 122¹.

C₂H₅N₂O₂ See *Ammonium oxalate-*.

C₂H₅N₂O₂ Bicarhamic acid, N-hydrazide, 245¹.

C₂H₅NO₂S Ethylsulfuric acid, NH₂OH salt,

3249¹.

C₂H₅N₂ Hydrazine, (β-aminoethyl), and di-

HCl, 3250¹.

C₂H₅BeN₂O₂S₂ + H₂O, 3071¹.

C₂H₅O₂ Ethyl peroxide, 2213¹.

C₂H₅Mo₂NO₂ Dimethylammonium molybdate,

2191¹.

C₂H₅FeN₂S₂, 448¹.

C₂H₅Na₂Mo₂NO₂, 1385¹.

C₂H₅Na₂Mo₂NO₂ + 10H₂O, 1385¹.

C₂H₅Na₂NO₂ + H₂O Ethylenediammonium

molybdate, 2191¹.

C₂H₅Co₂O₂Se + H₂O, 617¹.

C₂H₅Na₂Os₂, 617¹.

C₂Hg Mercury acetylide, 2631¹.

C₂HgN₂ See *Mercury cyanides-*.

C₂HgN₂O₂ See *Mercury cyanate; Mercury cyanide-*.

C₂I₂ Acetylene, diiodo-, 1125¹.

C₂I₂ Ethylene, tetraiodo-, 1125¹.

C₂K₂Na₂O₂ + 12H₂O, 789¹.

C₂K₂O₂ See *Potassium oxalate-*.

C₂MgO₂ See *Magnesium oxalate-*.

C₂MoNa₂O₂ Sodium molybdo-oxalate, 1545¹.

C₂MoO₂ + 3H₂O, 2609¹.

C₂N₂O₂ Oxycyanogen, 1996¹.

C₂N₂S₂ Thiocyanogen, 2329¹, 2334¹, 2460¹.

C₂N₂Se₂ Selenocyanogen, 1996¹.

C₂N₂Te₂ Tellurocyanogen, 1996¹.

C₂N₂Zn See *Zinc cyanide-*.

C₂N₂S₂ Carbon disulfide, azido-, 2460¹.

C₂Na₂O₂ See *Sodium oxalate-*.

C₂Ni Nickel acetylde, 2631¹.

C₂O₂Zn See *Zinc oxalate-*.

C₂O₂U Uranyl oxalate, 1097¹, 1098¹, 3183¹.

C₂O₂Osmium acetylde, 2631¹.

C₂Pd Palladium acetylde, 2631¹.

C₂Cl₂O₂Os, 942¹.

C₂H₅Mg₂O₂ + 3H₂O See *Hydromagnesite-*.

C₂H₅N₂O₂ Parabanic acid, 248¹.

C₂H₅AsCl₂NO₂ Arsine, (β-chlorovinyl)hydroxy-

thiocyano-, 3250⁴.

C₂H₅BrMg Methyl ethynylmagnesium bromide,

1695¹.

C₂H₅NO₂S Rhodanine, 1422¹.

C₂H₅NO₂ Acetic acid, cyano-, 2769¹.

C₂H₅N₂ Malononitrile, amino-, 2810¹.

C₂H₅N₂O₂ Allantoxaidine, 2189¹.

Imidazole, 4(or 5)-nitro-, 1706¹.

C₂H₅N₂O₂ Pyruvitrile, β-nitro-, oxime, 2808¹.

1,3,4 - Triazole - 2 - carboxylic acid, 5-

hydroxy-, 285¹.

C₂H₅Na Propine, Na deriv., 1695¹.

C₂H₅Br₂O₂ Propionic acid, α,β-dibromo-, 635¹.

C₂H₅ClN Propionitrile, β-chloro-, 2038¹.

C₂H₅Cl₂O₂ 2 Propanone, 1-dichloro-, 816¹,

3277¹.

C₂H₅Cl₂O₂ Propionic acid, α,β-dichloro-, 635¹.

C₂H₅N₂ Imidazole, 1732¹.

C₂H₅N₂O₂ Glycine, N-cyano-, 2052¹.

Wydanoin, 375¹, 507¹.

C₂H₅N₂S Compd., m. 220¹, from thiocarbo-

hydrazide and glyoxal sodium bisulfite

compd., 2206¹.

C₂H₅O See *Acrolein-*.

C₂H₅O₂ Acrylic acid, P 2057¹.

Pyruvaldehyde, 247¹, 3479¹.

C₂H₅O₂ See *Pyruvic acid-*.

C₂H₅O₂ See *Malonic acid-*.

C₂H₅Br Propene, 3-bromo-, 1980¹.

C₂H₅ClO 2-Propanone, 1-chloro-, 816¹.

Propionyl chloride, 2082¹, 3082¹.

C₂H₅ClO₂ Propionitrile acid, β-chloro-, 467¹, 635¹.

C₂H₅Cl₂O₂ Isopropyl, 704¹, 2083¹, 2864¹.

C₂H₅I Propene, 3-iodo-, 469¹.

C₂H₅N Propionitrile, 3248¹.

C₂H₅NO₂ Glycine, methylene-, Ba salt, 2809¹.

Isocyanic acid, methoxymethyl ester, 240¹.

C₂H₅NO₂S Malonic acid, thiol-, N₂H₄ salt,

40¹.

C₂H₅NO₂ Pyruvohydroxamic acid, 469¹.

C₂H₅NO₂S Compd., b. 125-30¹, from lactamide

and SOCH₃, 638¹.

C₂H₅N₂O₂ 4,4 - Triazetinedicarboxylic acid,

285¹.

C₂H₅N₂O₂ See *N-moglycerin-*.

C₂H₅ See *Propene-*.

C₂H₅Br Propene, α,1,3-dibromo-, 1862¹.

C₂H₅ClNO 2-Propanone, 1-chloro-, oxime,

2188¹.

- C₂H₅Cl₂O** Ether, β - chloroethyl chloromethyl, 2930².
- 2 - Propanol, 1,1 - dichloro-, 3277⁴.
- C₂H₅HgOS₂** Methylxanthic acid, methylmercuric deriv., 465⁴.
- C₂H₅N₂O⁺** Δ^2 - Oxazoline, 2 - amino-, and salts, 2052², 4.
- C₂H₅N₂O₂** Malonamide, 2931⁴.
- C₂H₅N₂O₂S** Ethanesulfonic acid, β -carbamido- β -keto-, *Ba salt*, 237⁴.
- C₂H₅N₂O** 1,2,3,4 - Tetrazole, 5 - ethoxy-, 515⁴.
- C₂H₅N₂OS** 1,3,4,6 - Thiodiazin - 5(4) - one, 2-hydrazono - 2,3 - dihydro-, 2206².
- C₂H₅N₂O₂** Pyruvonitrile, β -nitro-, oxime, NH₄ deriv., 2808¹.
- C₂H₅O** (See also *Acetone*; *Allyl alcohol*.)
Propene oxide, 1651⁴.
- C₂H₅O₂** (See also *Propionic acid*.)
Acetic acid, Me ester, 3056².
Acetol, 2229¹.
Propionic acid, 1604⁴.
- C₂H₅O₂S** Propionyl acid, α -mercapto-, and Na salts, 1245⁴.
- C₂H₅O₂** (See also *Lactic acid*.)
Acetone, dihydroxy-, 346¹.
Propanone, dihydroxy-, 247¹, 1868², 1898², 2531⁴, 3276¹, 3479¹.
Trioxymethylene, 238⁴, 769⁴, 1249², 1549².
- C₂H₅O₂** See *Glyceric acid*.
- C₂H₅O₂S** Propionic acid, α -sulfo-, and Na salts, 1245⁴.
- C₂H₅AsO₂** Δ^2 -Propenearsonic acid, P 2960².
- C₂H₅AsO₃** Propionic acid, α -arsono-, and Pb salt, 36⁴.
- C₂H₅Cl** Propane, 2-chloro-, P 2830⁴.
- C₂H₅ClO** Ether, chloromethyl ethyl, 2186¹, 2930².
- 1-Propanol, 2-chloro-, 468¹.
- C₂H₅IO₂** See *Alisal*.
- C₂H₅N** Isopropylideneimine, chlorostannate, 2652¹.
- C₂H₅NO₂** (See also *Alanine*; *Sarcosine*.)
Carbamic acid, ethyl ester, 3200¹.
Lactamide, 470⁴.
- C₂H₅NO₂S** See *Cysteine*.
- C₂H₅NO₂** Acetohydroxamic acid, methoxy-, 240⁴.
Carbamic acid, hydroxy-, Et ester, 909⁴.
Serine, 1128², 3255¹.
- C₂H₅O₂P** Lactic acid, α -phosphono-, and salts, 2028².
- C₂H₅** See *Propane*.
- C₂H₅ClN** Trimethylamine, α - chloro - (?), chloroplatinate, 1693².
- C₂H₅N₂O** Urea, s -dimethyl-, 754⁴.
- C₂H₅N₂** Pyruvaldehyde, dihydrazono-, 248².
- C₂H₅O** (See also *Isopropyl alcohol*; *Propyl alcohol*.)
Ether, ethyl methyl, 35¹.
- C₂H₅O₂** Propanediol, 970⁴, 3075¹, 3253².
- C₂H₅O₂Sn** Propanestannonic acid, 3227¹.
- C₂H₅O₂** See *Glycerol*.
- C₂H₅O₂P** Glyceric acid, diorthophosphate, 2076¹.
- C₂H₅Sn** Stannane, dimethylmethylene-, 3250⁴.
- C₂H₅IS** Trimethylsulfonium iodide, 1913¹.
- C₂H₅N** Trimethylamine, 1093², 1980², 2226⁴.
- C₂H₅NO** 2-Propanol, 1-amino-, 1128²; and chloroplatinate, 2809²; -HCl, 3253².
Trimethylamine oxide, 239⁴.
- C₂H₅NO₂** Propionic acid, NH₄OH salt, 2928².
- C₂H₅NO₂** Lactic acid, NH₄OH salt, 2928².
- C₂H₅N₂** Guanidine, dimethyl-, 1909⁴, 3232²; -HCl chloraurate, 2522².
- C₂H₅N₂O** Oxazolidine, 2,2-diamino-, -HCl, 2052⁴.
- 2-Propanone, 1,3 - diamino-, oxime di-HCl, 1827².
- C₂H₅NaSn** Stannane, trimethyl-, Na deriv., 2928².
- C₂H₅Sb** Stibine, trimethyl-, 1107².
- C₂H₅Sn** Trimethylstannyl, 2928².
- C₂H₅Cl₂PdSO₄**, 1107².
- C₂H₅N₂** Propylenediamine, 1972⁴.
- C₂H₅N₃** 1,2,3 - Propanetriamine, 820²; and salts, 1827², 3480².
- C₂Mg₂O₁₀** + 4H₂O, 424².
- C₂N₂** Cyanuric triazide, 1197², 1853².
- C₂O** Carbon suboxide, 40², 1254⁴.
- C₂S** See *Carbon sulfides*.
- C₂Se** See *Scandium carbide*.
- C₂BaN₂Pt** + 4H₂O See *Barium cyanoplatinite*.
- C₂FeO** Iron carbonyl, 1100².
- C₂HN₂** s -Maleimide, diiodo-, 1421².
- C₂HN** See *Iodole*.
- C₂HN** 1,2,3 - Triazole - 4,5 - dinitrile, 2810⁴.
- C₂H₂** Bincetylene, 1693¹, 2635⁴.
- C₂H₂BiNaO₂**, P 3147².
- C₂H₂BrN₂O₂** Hydantoin, 5 - (bromonitromethyl-ene)-, 2188².
- C₂H₂Br₂N₂O₂** See *Dibromic*.
- C₂H₂Br₂N₂S** 1,2 - Ethanediol, 1,2 dibromo-, dithiocyanate, 2335¹.
- C₂H₂Br₂** 2-Butene, 1,1,2,3,4,4-tetrahydro (?), 2472².
- C₂H₂Cl₂N₂O₂** Hydrazine, s -bis(trichloroacetyl), 815².
- C₂H₂Cl₂O** Ether, bis(tetrachloroethyl), 2031².
- C₂H₂S** Thiophene, diiodo-, 3085⁴.
- C₂H₂N₂O** 2,3,5 - Piperazinetrione, 3255².
- C₂H₂N₂O** 1,2,3 - Triazolecarboxylic acid, cyano-, 2810².
- C₂H₂N₂O** 3 - Furazancarboxamide, 4-cyano 2(or 5) oxide, 2808².
- C₂H₂O₂** Maleic anhydride, 1559⁴.
- C₂H₂O** Acetylenedicarboxylic acid, 2651².
- C₂H₂BrN₂O₂** Uracil, 5 bromo-, 2055².
- C₂H₂CuNaO₂**, 19⁴.
- C₂H₂KO₂** + 2H₂O See *Potassium oxalates*.
- C₂H₂N₂O** Hydantoin, 5 nitromethylene-, 2188².
- C₂H₂N₂O** 1,2,3 Triazole-4,5-dicarboxylic acid, 1 hydroxy-, K salt, 2808².
- C₂H₂AsBr₂** Arsenic, bromobis(β bromovinyl), 3250².
- C₂H₂Br** 1,3 Butadiene, 2,3-dibromo-, 1693².
- C₂H₂Br₂N** Imidazole, 2,4(or 2,5)-dibromo 5 (or 4) methyl-, 1706⁴.
- C₂H₂Br₂O** Succinic acid, α , β -dibromo-, 246².
- C₂H₂Cl₂O** (Glycol, bis(chloroformate)), 3269⁴.
- C₂H₂CuO** + 3H₂ Cuprimalic acid, 19⁴.
- C₂H₂HgKNO₂** Succinimide, mono-Hg compd., K salt, 1247².
- C₂H₂Hg₂KNO₂** Succinimide, di-Hg compd., K salt, 1247².
- C₂H₂KO₂Sb** + 1/2H₂O See *Tartar ematic*.
- C₂H₂N₂O** Uracil, 1130², 2055².
- C₂H₂N₂O** (See also *Barbituric acid*.)
2-Imidazolecarboxylic acid, 4,5-dihydro-4 keto-, 3085².
Isobarbituric acid, 2055¹, 3089².
- C₂H₂N₂O** Isodisturic acid, 2055¹.
- C₂H₂N₂** Malononitrile, aminohydrocyanide, 1313⁴.
- C₂H₂N₂O** Isocyanilic acid, and salts, 2807².
Metacyanilic acid, 2808².
- C₂H₂O** Ethylene oxide, ethyl-, 2472².
Furan, 1191².

- C₂H₃O₂** Propiolic acid, Me ester, 2324.
 Tetrolic acid, 2651.
C₂H₃O₂N Succinimide, iodo-, 2891.
C₂H₃O₂ Succinic anhydride, 2196.
C₂H₃O₂ See *Fumaric acid*; *Maleic acid*.
C₂H₃O₂ Ethylene oxide- α , β -dicarboxylic acid, and salts, 2477.
C₂H₃O₂ Oxalacetic acid, 2633, 2695, P 2606.
C₂H₃O₂ Maleic acid, dihydroxy-, 2477.
C₂H₃S See *Thiophene*.
C₂H₃AsCl₂O₂ Arsinic acid, bis(β -chlorovinyl)-, 3250.
C₂H₃BrClNO Acetic acid, bromochloronitro-, Et ester, 2027.
C₂H₃BrN Imidazole, 4(or 5)-bromo-5(or 4)-methyl-, 1706.
C₂H₃BrO₂ Malic acid, β -bromo-, 2477.
C₂H₃BrNO Acetic acid, dibromonitro-, Et ester, 2027.
 Ethanol, 2,2-dibromo-2-nitro-, acetate, 1406.
C₂H₃ClN Pyrazole, 5-chloro-3-methyl-, 2952.
C₂H₃ClO₂ Malic acid, β -chloro-, 2477.
C₂H₃Cl₂NO Acetic acid, dichloronitro-, Et ester, 2027.
C₂H₃Cl₃O Butyraldehyde, α , α , β -trichloro-, 2683.
C₂H₃N (See also *Pyrrole*).
 Butenitrile, 37, 2324, 3057.
 Crotonitrile, 2324.
 Cyclopropanenitrile, 2324.
 Isocrotonitrile, 2324.
C₂H₃NO Oxazine, 733, 2372.
C₂H₃NO Formic acid, cyano-, Et ester, 822.
C₂H₃NS Allyl isothiocyanate, 1389.
 Thiazine, 733, 2372.
C₂H₃N₂O Cytosine, 1130.
C₂H₃N₂O₂S Imidazolemercaptan, 2-methylnitro-, and -HCl, 3271.
C₂H₃N₂O₂ Hydantoic acid, δ -cyano-, 2052.
C₂H₃N₂O₂ Allantoxanic acid, and K salt, 2189.
C₂H₃ Erythrene, 2003.
C₂H₃As₂O₂ Acetic acid, arsenobis-, di-Na salt, 1165.
C₂H₃As₂O₂ Acetic acid, diarsenobis-, mono-Na salt, 1165.
C₂H₃BaO See *Barium acetate*.
C₂H₃BeCl₂N₂, 3071.
C₂H₃BrNO Acetic acid, bromonitro-, Et ester and NH₃ addn. compd., 2027.
C₂H₃Br₂O Erythrol, 3,4-dibromo-, 2472.
C₂H₃Br₂ Butane, 1,2,3,4-tetrabromo-, 1693.
C₂H₃CaO See *Calcium acetate*.
C₂H₃ClNO Acetic acid, chloroisonitro-, Et ester, salts, 2326, 2327.
 —, chloronitro-, Et ester, NH₃ addn. compd., 2027.
C₂H₃Cl₂N₂O₂S Acetamide, N,N'-thiobis(α -chloro-), 815.
C₂H₃Cl₂O Butyraldehyde, α , β -dichloro-, 241.
C₂H₃Cl₂O₂Te Telluridiacetic acid, dichloro-, 1696.
C₂H₃CoO₂ + 4H₂O See *Cobalt acetate*.
C₂H₃CuO₂ See *Copper acetate*.
C₂H₃HgO₂ See *Mercury acetate*.
C₂H₃MgO₂ See *Magnesium acetate*.
C₂H₃MnO₂ See *Manganese acetate*.
C₂H₃N Crotonitrile, β -amino-, 245.
 Imidazole, methyl-, 2972.
C₂H₃N₂O₂ (See also *Piperazinedione*).
 Acetic acid, diazo-, Et ester, 2476.
C₂H₃N₂O₂ Glycine, N-(aminocyanaminomethyl-)-(?), and salts, 2052.
 5-Oxazolidone, 2-amino-2-cyanomethyl-, (?), and salts, 2052.
C₂H₃N₂O See *Allantoin*.
C₂H₃N₂O₂ Compd., m. 175°, from isocyanilic acid and KOH, 2808.
 Erythrocyanilic acid, and salts, 2808.
 Oxalacetaldehyde, nitro-, trioxime-, 2808.
C₂H₃O Δ^2 -2-Butenone, 656.
 2-Butin-1-ol, 1695.
 Crotonaldehyde, 634, P 657.
 Ketene, dimethyl-, 1254, 2188, 2658.
 Vinyl ether, P 3491.
C₂H₃O Acetic acid, vinyl ester, P 3491.
 Biacetyl, 2187.
 3-Butene-1,2-diol, 2472.
 Crotonic acid, 634, 1401, 1695, 2475.
 Isocrotonic acid, 1695.
C₂H₃O See *Acetic anhydride*; *Acetoacetic acid*.
C₂H₃O (See also *Succinic acid*).
 Itaconic acid, 923.
 Oxalic acid, di-Me ester, 1704, 1704, SnCl₄ addn. compd., 50.
C₂H₃O₂Pb See *Lead acetate*.
C₂H₃O₂S Diglycolic acid, thio-, Na Ag salt, P 3801.
 Succinic acid, mercapto-, 1130, and Na salt, 1258.
C₂H₃O₂Te Acetic acid, tellurobis-, and salts, 1696.
C₂H₃O₂Te Acetic acid, ditellurobis-, 1696.
C₂H₃O₂U Uranium acetate, 2215.
C₂H₃O See *Malic acid*.
C₂H₃O See *Tartaric acid*.
C₂H₃O₂U + 3H₂O Uranyl acetate, 1519.
C₂H₃O₂S Succinic acid, α -sulfo-, and K salt, 1245.
C₂H₃Br Butene, bromo-, 3057.
 Propene, 3-bromo-2-methyl-, 2930.
C₂H₃BrO Isobutyl bromide, 2640.
C₂H₃ClN₂O Oxazolidine, 5-chloromethyl-2-imino-, 2052.
C₂H₃ClO 2-Butanone, 3-chloro-, 1581.
 Butyraldehyde, β -chloro-, 242.
 Ether, β -chloroethyl vinyl, 1413.
 Isobutyl chloride, 2032, 3082.
C₂H₃ClO Acetic acid, chloro-, Et ester, 1804.
 Propionyl chloride, β -methoxy-, 240.
C₂H₃Cl₂NO Aleudrin, 816.
C₂H₃Cl₂O 1-Butanol, 2,2,3-trichloro-, 2683.
 Propanol, trichloromethyl-, 1313, 1918, 2085.
C₂H₃N Isobutyronitrile, 3246.
C₂H₃NO Crotonamide, 3253.
 Isocrotonamide, 3253.
C₂H₃NO Isocyanic acid, ethoxymethyl ester, 240.
 —, β -methoxyethyl ester, 240.
C₂H₃NO Aceturic acid, 401.
C₂H₃NO Succinamic acid; β -mercapto-, 1130.
C₂H₃NO (See also *Aspartic acid*).
 Glycolohydroxamic acid, acetate, and salts, 240.
C₂H₃N₂O See *Creatinine*.
C₂H₃N₂S 2(3)-Imidazolone, 4-methylamino-2-thio-, 2089.
C₂H₃ Butene, 731, 3124, 3417.
C₂H₃Br₂ClSe Selenide, bis(β -bromoethyl), dichloride, 3248.
 —, bis(β -chloroethyl), dibromide, 3248.
C₂H₃Br₂Se Selenide, bis(β -bromoethyl), 3248.
C₂H₃Br₂Se Selenide, bis(β -bromoethyl), dibromide, 3248.
C₂H₃OdN₂OdN₂, 21.
C₂H₃ClO Ether, bis(β -chloroethyl), 634, 1413.

- C_2H_5ClSe Selenide, bis(β -chloroethyl), di-chloride, 3249.
 $C_2H_5HgO_2$ Xanthic acid, methylmercuric deriv., 465.
 $C_2H_5NO_2$ Bisacetyl dioxime, 3226.
 Glyoxime, dimethyl-, 240, 2476.
 5 - Oxazolidinecarbinol, 2 - imino-, chloroplatinat, 3052.
 $C_2H_5N_2O_2$ (See also *Asparagine*; *Glycine*, *glycyl*.)
 Acetamide, α -glycolylamino-, 470.
 $C_2H_5N_2O_2S$ Propanesulfonic acid, γ -carbamido- γ -keto-, salts, 237.
 $C_2H_5N_2S$ Urea, α -allylthio-, 2513.
 $C_2H_5N_2OS$ Imidazolemercaptan, 2 - methyl-nitro-, NH₂ deriv., 3271.
 C_2H_5O (See also 2-*Butanone*.)
 Δ^2 -2-Butenol, 240, 2331.
 Butyraldehyde, 238, 1247, P 3490.
 Isobutyraldehyde, 2807.
 $C_2H_5O_2$ (See also *Butyric acid*; *Ethyl acetate*; *Isobutyric acid*.)
 Acetaldo, 2445.
 Butanone, hydroxy-, 305, 1558, 2386, 3510.
 Butyraldehyde, γ -hydroxy-, 468.
 2-Furanol tetrahydro-, 468.
 $C_2H_5O_2$ (See also *Butyric acid*, β -hydroxy.)
 Acetic acid, ethoxy-, K salt, 1992.
 Lactic acid, Me ester, 244.
 Methanol, ethoxy-, formate, 2930.
 Propionic acid, β -methoxy-, 240.
 $C_2H_5O_2$ Isobutyric acid, α , β -dihydroxy-, and salts, 2189.
 Tetraoxymethylene, 1246.
 $C_2H_5O_2S$ Butyric acid, α -sulfo-, 37.
 C_2H_5OS Diethylene 1,2,5 - trisulfide, 1557.
 $C_2H_5AsO_2$ Acetic acid, arsono-, Et ester, 36.
 C_2H_5Br Butane, 2-bromo-, 1850.
 C_2H_5BrMgO Butoxymagnesium bromide, 2324.
 Ethylmagnesium bromide, ethylene oxide compd., 2324.
 C_2H_5BrO Ether, β -bromoethyl ethyl, 2186.
 $C_2H_5BrO_2$ Acetic acid hydrobromide perbromide, 816.
 C_2H_5ClO Ether, chloromethyl isopropyl, 295.
 C_2H_5NO Butyramide, 3253.
 $C_2H_5NO_2$ Butyl nitrite, 2927.
 Butyramide, β -hydroxy-, 2809.
 Glycine, Et ester, 1804.
 $C_2H_5NO_2$ Acetohydroxamic acid, ethoxy-, 240.
 Carbamic acid, hydroxy-, Pr ester, 909.
 Propionhydroxamic acid, β -methoxy-, 240.
 $C_2H_5NO_2S$ Taurine, *N*-acetyl-, Na salt, 2808.
 $C_2H_5N_2$, 3227.
 C_2H_5 See *Butane*.
 C_2H_5BrO Ethyl ether, tribromide, 1983.
 $C_2H_5CaO_2$ Calcium ethoxide, 3251.
 C_2H_5FTl Diethylthallic fluoride, 1232.
 $C_2H_5Hg_2$, 3069.
 $C_2H_5MgO_2$ Magnesium ethoxide, 3251.
 $C_2H_5NO_2$ See *Piperazine*.
 $C_2H_5NO_2$ Butyric acid, β -hydroxy-, hydrazide, 2253.
 $C_2H_5N_2S$ Pseudourea, α , α , γ - trimethylthio-, 1696.
 C_2H_5O See *Butyl alcohol*; *Ethyl ether*; *Isobutyl alcohol*.
 $C_2H_5O_2$ Acetaldehyde, di-Me acetal, 1556.
 Butyraldo, 3075, 3510.
 $C_2H_5O_2S$ Ethyl sulfone, 3489.
 $C_2H_5O_2S$ 2-Butanesulfonic acid, and *Et* salt, 1249.
 $C_2H_5O_2$ Erythritol, 1163, 3418.
 Peroxide, bis(α -hydroxyethyl), 1164.
 $C_2H_5O_2S$ See *Ethyl sulfide*.
 C_2H_5S sec-Butyl mercaptan, 1245.
 Ethyl sulfide, 351, 3488.
 $C_2H_5S_2$ Ethyl disulfide, 2027.
 $C_2H_5S_2$ Ethyl mercaptan, 2,2'-thiois-, 1557.
 C_2H_5Zn Zinc ethyl, 1387, 2636.
 $C_2H_5AsI_4$ Iodomethyltrimethylarsonium iodide, 1913.
 $C_2H_5AsO_2$ 1-Butanearsonic acid, 478.
 C_2H_5IN Iodomethyltrimethylammonium iodide, 1913.
 C_2H_5N Diethylamine, -HCl, 2440.
 Isobutylamine, and -HCl, 2440, 3478.
 C_2H_5NO Hydroxylamine, α -butyl-, 2186.
 $C_2H_5NO_2$ Butyric acid, NH₂OH salt, 2928.
 Isobutyric acid, NH₂OH salt, 2928.
 New amino acid, from protein teozin, 976.
 $C_2H_5NO_2S$ Taurine, *N*, *N*-dimethyl-, 2808.
 $C_2H_5NO_2$ Butyric acid, hydroxy-, NH₂OH salt, 2928.
 $C_2H_5NO_2O$ Oxazolidine, 2 - amino - 2 - methyl-amino-, -HCl, 2052.
 $C_2H_5O_2P$ Phosphinic acid, diethyl-, Ag salt, 2323.
 $C_2H_5AsI_4$ Tetramethylarsonium iodide, 1913.
 $C_2H_5As_2O_2U$ Cacodylic acid, uranyl salt, 1756.
 C_2H_5ClN Tetramethylammonium chloride, 1073, 2440.
 C_2H_5ClNO Rutoxammonium chloride, 2186.
 $C_2H_5ClCrNO$, 1385.
 C_2H_5IN Tetramethylammonium iodide, 1913, 2906.
 C_2H_5INO Methoxytrimethylammonium iodide, 238.
 C_2H_5IP Tetramethylphosphonium iodide, 1913.
 C_2H_5ISb Tetramethylstibonium iodide, 1913.
 $C_2H_5IN_2Pt$, 1386.
 $C_2H_5Mo_2N_2O_{11}$ Ammonium dimolybdo-malate, 1545.
 $C_2H_5N_2$ (See also *Putrescine*.)
 Hydrazine, isobutyl-, and salts, 3478.
 $C_2H_5Na_2Sn_2$ Distannane, s-tetramethyl-, di-Na deriv., 3250.
 C_2H_5NO Tetramethylammonium hydroxide, 1081.
 $V_2H_5Cl_2CoN_2O + H_2O$, 681.
 $C_2H_5Br_2Mo_2N_2O_2$, 1386.
 $C_2H_5Cl_2CoN_2O$, 681.
 $C_2H_5Br_2CoN_2O$, 681.
 $C_2H_5Br_2ClN_2$, 3071.
 $C_2H_5Cl_2CoN_2O + 2H_2O$, 681.
 $C_2H_5CoN_2O_2Se + 2H_2O$, 617.
 $C_2H_5CoN_2O_2Se + 3H_2O$, 617.
 $C_2H_5O_2 + 6H_2O$, 2609.
 $C_2N_2O_2$ 3,4 - Furazandinitrile, 2 - oxide, 2808.
 C_2N_2O Nickel carbonyl 20.
 $C_2FeN_2Na_2O$ Sodium nitroprusside, 1995.
 $C_2FeN_2Na_2O$ Sodium hyponitriteferropentacyanide, 2460.
 $C_2FeO_2 + 2H_2O$, 1109.
 $C_2H_5NO_2$ 2 - Pyrrolealdehyde, tetraiodo-, 1421.
 $C_2H_5Br_2N_2O_2$ Pyridine, 2-bromo-4-hydroxy-5-nitro-, 72.
 C_2H_5OIN Pyridine, 2 - chloro - 5 -, 1424.
 $C_2H_5ClN_2O_2$ Pyridine, 4-chloro nitro-, and chloroplatinat, 72.
 C_2H_5ClN Pyridine, 3,4-dichloro-, HgCl, 71.
 $C_2H_5Cl_2O$ Cyclopentanone, 3,2,3,4,5 - penta-

- C₂H₅N₂O₄** 4 - Pyridol, 3,5 - dinitro-, and mono Na deriv., 72¹.
C₂H₅AsCl₂N Arsine, bis(β-chlorovinyl)ciano-, 3250⁷.
C₂H₅BrN₂O₂ Pyridine, 4-amino-3-bromo-5-nitro-, and chloroplatinate, 71⁸.
C₂H₅ClN Pyridine, 4-chloro-, 71¹.
C₂H₅INO₂ 2-Pyridol, 5-iodo-, 1424⁴.
C₂H₅INO₂ Pyridine, 5-iodo-2-nitramino-, 1424⁴.
C₂H₅N₂O Pyridine, 3-nitroso-, 2053⁹.
C₂H₅N₂O₂ Pyridine, 3-nitro-, 2053⁹.
C₂H₅N₂O₂ 2,3,5 - Piperazinetrione, 6-methyl-, 3255¹.
 4-Pyridol, 3-nitro-, 71^{4,5}.
C₂H₅N₂O₂ 4,5-Imidazolidicarboxylic acid, 2825¹.
C₂H₅N₂O See *Hypoxanthine*.
C₂H₅N₂O₂ See *Xanthine*.
C₂H₅N₂O₂ (See also *Uric acid*).
 Pyridine, 5 - nitro - 2 - nitrosoamino-, 2823¹.
C₂H₅N₂O₂ Pyridine, 4-amino-3,5-dinitro-, and derivs., 71^{2,4}.
 --, nitraminonitro-, 2823¹; and *derivs.*, 71^{2,4}.
C₂H₅O₂ 1,4-Pyrone, 4-thio-, 516².
C₂H₅O₂ See 2-Furaldehyde.
C₂H₅O₂ Pyromucic acid, 2197².
C₂H₅Br₂Mo₂N 1386⁶.
C₂H₅ClN₂O 1 - Pyrazolocarboxyl chloride, 2053⁹.
C₂H₅ClO Furan, 2-(chloromethyl), 277².
C₂H₅Cl₂CrN + 2H₂O, 3071².
C₂N₂Cl₂MoNO, 3439¹.
C₂H₅IN Pyridine, 2 amino 5-iodo, and salts, 1424^{1,4}.
C₂H₅IN See *Pyridine*.
C₂H₅INO Pyridol, 69², 71⁴, 1275⁴.
 2(1)-Pyridone, 3489⁷.
 2-Pyrolealdehyde, 1420⁶.
C₂H₅NO₂S 3 - Pyridinesulfonic acid, 4 - hydroxy-, 1270².
C₂H₅N₂NaO 2 - Pyridol, 5 - amino-, Na deriv., 2823¹.
C₂H₅N₂O₂ Pyridine, 4-amino-3-nitro-, 72², and derivs., 71^{1,4,5}.
 --, nitramino, 1863⁹, and derivs., 70^{2,3}.
C₂H₅N₂ See *Adenine*.
C₂H₅ Cyclopentadiene, 2490¹.
C₂H₅BrN₂O 1 - Pyrazolocarboxamide, 1 bromo 3 methyl-, 2953⁹.
C₂H₅Br₂Cl₂NW₂, 618⁴.
C₂H₅Br₂Mo₂N, 1386⁶.
C₂H₅ClN Pyridine, 4,5 diamino 2-chloro-, and -HCl, 71⁴.
C₂H₅Cl₂N Pyridine, 3,4,5 triamino 2,6-di chloro⁶, and -HCl, 71².
C₂H₅Cl₂O 1,3 - Propanediol, bis(chloroformate), 3269¹.
C₂H₅IN Pyridinium triiodide, 1403⁹.
C₂H₅N (See also *Pyridine, amino*).
 Pyridine, 2(1)-dihydro-2 imino-, 69².
C₂H₅N₂O Hydroxylamine, β - 3 - pyridyl-, 2053⁹.
 2-Pyridol, 5-amino-, 2823¹.
C₂H₅N₂O₂ Anhydroglycyl - di - serine anhydride, 3255¹.
 2,5 - Piperazinedione, α3-methylene-, 3255¹.
 Serine, N-glycyl-, anhydride, 638^{4,5}.
 Thymine, 2055², 2641¹.
 Uracil, methyl-, 2055².
C₂H₅Mo₂O Compd., m. 105.7³, from 3-methyl-isodialuric acid and CO(NHCH₃), 1240⁶.
Isobarbituric acid, 3-methyl-, 1240⁶.
C₂H₅Mo₂S 3 - Hydantoinacetic acid, 2 - thio-, 637⁴.
 3 - Pyridinesulfonic acid, 4 - amino-, and salts, 1276⁴.
C₂H₅N₂O₂ 3 - Hydantoinacetic acid, 637⁴.
 Isodialuric acid, 3-methyl-, 1240⁶.
C₂H₅N₂O₂ Pyridine, 4-hydrazino-3-nitro-, 72².
C₂H₅O Furan, 3-methyl-, 1139².
 3-Pentin-2-one, 1605⁹.
C₂H₅O₂ 2-Furancarbinol, 277².
 Glutaconaldehyde, and di-NaHSO₃ deriv., 517^{4,5}.
 α,γ - Pentadienaldehyde, δ - hydroxy-, salts, 517^{4,5}.
 α,γ - Pentadienic acid, 3485⁴.
C₂H₅O₂ Malonic anhydride, dimethyl-, 2188⁴.
C₂H₅O₂ Citraconic acid, 923⁴.
 Itaconic acid, 1401⁴.
 Mesaconic acid, 923⁴.
C₂H₅O₂ Oxycitraconic acid, Ba salt, 2477⁴.
C₂H₅O₂ 1,3 - Dioxole - 4,5 - dicarboxylic acid, 4,5-dihydro-, 248⁸.
C₂H₅AsCl₂ Arsine, bis(β-chlorovinyl)methyl-, 3250⁷.
C₂H₅BF₂O 2,1-Pentanediene, compd with BF₃, 220⁶.
C₂H₅BrO Malonic acid, β-bromoethyl-, 2808⁹.
C₂H₅ClN₂ Pyrazole, chlorodimethyl-, 2952³.
C₂H₅ClO Propionic acid, β-chloroformyl-, Me ester, 1128².
C₂H₅NO₂ Acetic acid, cyano-, Et ester, 969³.
C₂H₅NO Acid, m. 90⁹, from anhydroglycyl-serine anhydride, 1852⁶.
C₂H₅N Pyridine, 3,4-diamino-, and chloroplatinate, 70^{2,3}.
 4 hydrazino-, 71⁴.
C₂H₅N₂O 1 - Pyrazolocarboxamide, methyl-, 2953⁹.
C₂H₅N₂O₂ Imidazole, dimethylnitro-, and -HCl, 3271^{3,5}.
C₂H₅ (See also *Isoprene*).
 1-Pentine, 3276⁴.
C₂H₅BrNO Propionic acid, α-bromo-α-nitro-, Et ester, 2027².
C₂H₅CINO Sarcosine, N chloroacetyl-, 1129¹.
C₂H₅CINO Propionic acid, α-chloro-α-nitro-, Et ester, 2027².
C₂H₅Cl₂NO₂, 618⁴.
C₂H₅N Dehydro-2-piperidazine, endomethylene-, and salts, 2499³.
C₂H₅N₂O₂ 2,5 Piperazinedione, 3-methyl-, 302², 2869⁴, 2810¹.
C₂H₅N₂O Oxamic acid, N-carbamyl-N-ethyl-, NH₄ salt, 2933⁹.
 Thymine, dihydro-5,6-dihydroxy-, 2641¹.
C₂H₅N₂S Imidazolemercaptan, dimethyl-, 1709⁶.
 Thiazole, 4 methyl-2 methylamino-, and HCl, 1709⁶.
C₂H₅N₂O₂ Pyuril, 637⁴.
C₂H₅N₂O₂ Pentaerythritol tetranitrate, 2892³.
C₂H₅O₂ 2-Furaldehyde, tetrahydro-, 278¹.
 2,4-Pentanedione, 39², 2187¹, 2332², 3082².
 γ-Pentenic acid, 3251².
 Senecioic acid, 204⁸, 217⁹.
C₂H₅O₂ Levulinic acid, 3480⁷.
 Plantenolic acid, 1720².
C₂H₅O₂ Glutaric acid, 1802¹, 2454².
 Malonic acid, di Me ester, NaCl and SnBr₄ addn. compds., 50², 51².
 Methylene diacetate, 1245⁹.
C₂H₅O₂S Propionic acid, α-(carboxymethyl-thio)-, 923⁴.
C₂H₅O₂ Arabinic acid, γ-lactone, 817².
 Formic, di-, 2931⁶.
C₂H₅O₂ Tartaric acid, methyl-, 2477².

- ~~C₂H₅BrN₂O₂~~ Malonamide, α -bromo-*N*-ethyl-, 1699.
 C₂H₅BrO Isovaleryl bromide, 2640.
 C₂H₅ClO Butyryl chloride, α -methyl-, 2051.
 Isovaleryl chloride, 2032, 2082.
 C₂H₅ClO₂ Lactylsulfinyl chloride, Et ester, 638.
 C₂H₅Cl₂N₂O Butyraldehyde, α, β -dichloro-, semicarbazone, 241.
~~C₂H₅N~~ Isovaleronitrile, 825, 3248.
 C₂H₅NO Δ^2 -2-Pentenone, 4-amino-, 245.
 C₂H₅NO₂ 2-Piperidone, 3,5-dihydroxy-, 635.
 C₂H₅NO₂ (See also *Glutamic acid*).
 Acetohydroxamic acid, methoxy-, acetate, and salts, 240.
 Glycine, triformal-, Cu salt, 2800.
 Propionic acid, α -nitro-, Et ester, N₂H₄ addn. compd., 2027.
 C₂H₅N₂ See *Histamine*.
 C₂H₅N₂O₂ Urazole, 1-isopropyl-, 642.
 C₂H₆ (See also *Pentene*).
 Butene, methyl-, 1401.
 C₂H₅HgOS₂ Xanthic acid, ethylmercuric deriv., 465.
 C₂H₅NaO + H₂O Isovaleraldehyde, oxime, Na salt, 2475.
 C₂H₅N₂ Base from 1,2-dimethyl-5-nitroimidazole, 3271.
 Piperidazine, endomethylene-, and chloro-, 2499.
 C₂H₅N₂O₂ Glutaraldehyde, dioxime, 1111.
 Malonamide, *N, N'*-dimethyl-, 2931.
 —, *N*-ethyl-, 1696.
 C₂H₅N₂O₂ Glycine, alanyl-, 302, 2033.
 —, *N*-sarcosyl-, 1129.
 Sarcosine, *N*-glycyl-, 1128.
 C₂H₅N₂O₂ 1,3-Propanediol, dicarbamate, 3269.
 C₂H₅O Ether, methyl β -methylallyl-, 2930.
 Ethylene oxide, trimethyl-, 1651.
 3-Pentanone, 240, 2637.
 Pentenol, 2331, 4691.
 C₂H₅O₂ Butyric acid, methyl ester, 1081.
 Isovaleric acid, 3251.
 Pentanone, hydroxy-, 1558.
 Valeric acid, 467, 1079, 1694, 3251.
 C₂H₅O₂ Butyric acid, β -hydroxy-, Me ester, 3253.
 Carbonic acid, di Et ester, 2927.
 Lactic acid, Et ester, 244, 1060.
 Methanol, ethoxy-, acetate, 2930.
 Methanol, isopropoxy-, formate, 2030.
 Valeric acid, γ -hydroxy-, 3411.
 C₂H₅O₂ Monoacetin, P 771.
 C₂H₅O₂ See *Arabinose*; *Lyxose*; *Xylose*.
 C₂H₅AsO₂ Propionic acid, α -arsono-, Et ester, 36.
 C₂H₅Br Pentane, bromo-, 1854.
 C₂H₅BrO₂ Hydroxymethyldimethylsulfonium bromide, acetate, 1919.
 C₂H₅ClO Ether, *sec*-butyl chloromethyl-, 2930.
 C₂H₅ClO₂ Ether, (β -chloroethyl) (β -methoxyethyl), 634.
 C₂H₅N See *Piperidine*.
 C₂H₅NO₂ (See also *Amyl nitrite*; *Betaine*).
 Isoamyl nitrite, 2927.
 Sarcosine, Et ester, 3254.
 Valine, 1129.
 C₂H₅NO₂ 308.
 Carbamic acid, hydroxy-, Et ester, 969.
 C₂H₅NO₂ Valeric acid, 4-amino- α, γ -dihydroxy-, and Cu salt, 635.
 C₂H₅NH₂ Carbamic acid, diethylthio-, salts, 979.
 C₂H₅ See *Pentane*.
 C₂H₅N₂ 1,3-Cyclopentanediamine, di-HCl, SnCl₄ compd., 2499.
 C₂H₅N₂O₂ See *Ornithine*.
 C₂H₅O (See also *Amyl alcohol*; *Isoamyl alcohol*).
 Ether, ethyl propyl-, 351.
 C₂H₅O₂ 1,2-Cyclopentanediol, 970.
 Formaldehyde, diethylacetal, 1992.
 C₂H₅O₂ 2,3,4-Pentanetriol, 2326.
 C₂H₅O₂ Pentaglyceritol, 754.
 C₂H₅NO₂ See *Muscarine*.
 C₂H₅NO₂ Valeric acid, NH₄OH salt, 2928.
 C₂H₅N₂ Guanidine, tetramethyl-, 1696, 1909.
 C₂H₅ClOP₂ β -Hydroxyethyltriprimethylphosphonium chloride, 1913.
 C₂H₅INO Ethoxytrimethylammonium iodide, 238.
 C₂H₅N₂ Agmatine, 1014, 3277.
 C₂H₅NO₂ See *Choline*.
 C₂Br₂ Benzene, hexabromo-, 754.
 C₂Cl₂N₂O₂ Quinone, 2,5-dichloro-3,6-ditriazo-, 644.
 C₂Cl₂N₂O₂ Quinone, 2,3,5-trichloro-6-triazo-, 644.
 C₂Cl₂N₂O₂ Benzene, tetrachlorodinitro-, 3482.
 C₂Cl₂O Chloranil, 6039, 3260.
 C₂Cl₂ Benzene, hexachloro-, 754.
 C₂Cu₂FeN₂ See *Copper ferrocyanide*.
 C₂FeH₂N₂ See *Ferrocyanic acid*.
 C₂FeK₂N₂ See *Potassium ferrocyanide*.
 C₂FeN₂Na₂ Sodium ferrous ferrocyanide, P 1035.
 C₂HCl₂NO₂ Benzene, tetrachloronitro-, 3482.
 C₂HCl₂NO₂ Phenol, 4-dichloroamino-, 2,3,5,6-tetrachloro-, 2049.
 C₂H₂Bi₂Na₂O₂ + 2H₂O, 1545.
 C₂H₂Br₂ClN₂O₂ Benzene, 1-bromo-2-chloro-3,5-dinitro-, 980.
 C₂H₂Br₂ClN₂ 2,4,6-Tribromobenzenediazonium chloride, PbCl₂ double salt, 470.
 C₂H₂Br₂ClIN₂ 2,4,6-Tribromobenzenediazonium tetrachloroiodide, 470.
 C₂H₂CINO₂ 2-Furancarboxyl chloride, 3-cyano-, 1139.
 C₂H₂CIN₂O₂ (See also *Phenyl chloride*).
 Benzene, chloronitro-, 2539, 2541.
 C₂H₂CIN₂O₂ Phenol, 3-chloro-2,5,6-trinitro-, and salts, 2937.
 C₂H₂Cl₂O₂ Quinone, 2,6-dichloro-, 2039.
 C₂H₂Cl₂N₂ Aniline, pentachloro-, P 300.
 C₂H₂N₂O₂ Benzene, 1,5-dinitro-2,3-dinitroso-, 645.
 C₂H₂N₂O₂ Benzene, 2,4,6-trinitro-1-triazo-, 645.
 C₂H₂BrN₂O₂S Benzenesulfonic acid, 4-bromo-3,5-dinitro-, 2824.
 C₂H₂Br₂ClN₂ 2,4-Dibromobenzenediazonium chloride, PbCl₂ double salt, 470.
 C₂H₂Br₂ClIN₂ 2,4-Dibromobenzenediazonium tetrachloroiodide, 470.
 C₂H₂CIN₂O₂ Benzene, 1-chloro-2,4-dinitro-, 2039, 2039.
 C₂H₂CIN₂O₂ Phenol, chlorodinitro-, 981, and Ag salt, 2937.
 C₂H₂CIN₂O₂S Benzenesulfonic acid, 4-chloro-3,5-dinitro-, 2824.
 C₂H₂Cl₂O₂ Quinone, chloro-, 2039.
 C₂H₂Cl₂O₂S Benzenesulfonyl iodide, 2,5-dichloro-, 3259.
 C₂H₂Cl₂N₂ Benzene, 1,4-dichloro-2-nitro-, 1412.
 C₂H₂Cl₂N₂ Benzene, dichloro-1-triazo-, 470.
 C₂H₂Cl₂N₂ Dichlorobenzenediazonium chloride, PbCl₂ double salt, 470.

- C₆H₅Cl₂S** Benzenesulfonyl chloride, 2,5-dichloro-, 1138⁴.
C₆H₅Cl₄N Aniline, tetrachloro-, P 300⁴.
C₆H₅Cl₄N₂ Dichlorobenzenediazonium tetrachloroiodide, 476⁴.
C₆H₅FeN₃ See *Ferricyanide acid*.
C₆H₅NO₂ 2 - Furancarboxylic acid, 3 - cyano-, 1139⁴.
C₆H₅N₂O Benzene, 1,3,5-trinitro-, 3258¹.
C₆H₅N₂O₇ (See also *Picric acid*).
 Phenol, trinitro-, 3010⁴.
C₆H₅N₂O₂ Resorcinol, trinitro-, *Pb salt*, 1197⁴.
 Styphnic acid, 1137¹.
C₆H₅N₂O₃ Phloroglucinol, 2,4,6 - trinitro-, 2041¹.
C₆H₅N₂O₃S Benzenesulfonic acid, 2,4,6-trinitro-(?), 1561⁴.
C₆H₅N₃ + 3H₂O Melamine, tricyano-, 3227⁴.
C₆H₅AgN₃ 2,1,3 - Benzotriazole, Ag deriv., 514⁴.
C₆H₅BrClN₂ Bromobenzenediazonium chloride, *PbCl₂ double salt*, 476⁴.
C₆H₅BrNO Benzene, 1-bromo-4-nitroso-, 1699⁴.
C₆H₅BrNO₂ Benzene, bromonitro-, 464⁴, 2894¹, 3200⁴.
C₆H₅BrNO₂ Phenol, bromonitro-, 2340⁴.
C₆H₅BrN₃ Benzene, 1 bromo-4-triazo-, 2341⁴.
C₆H₅Br₂ Benzene, dibromo-, 42⁴.
C₆H₅ClNO Benzene, 1-chloro-4-nitroso-, 1699⁴.
C₆H₅ClNO₂ Benzene, chloronitro-, 1412⁴, 1743¹, 2036⁴, 2894¹, 2923⁴, 3200⁴, 3405⁴.
 Nicotinic acid, 2-chloro-, 518⁴.
C₆H₅ClNO₂ Phenol, 3-chloronitro-, 2340⁴, and *Ag salt*, 2937¹.
C₆H₅ClN₂ Benzene, 1 chloro-4 triazo-, 2341⁴.
C₆H₅ClN₂O₂ o - Nitrobenzenediazonium chloride, *PbCl₂ double salt*, 476⁴.
C₆H₅ClN₂O₂ Aniline, chlorodinitro-, 642⁴, 2824¹.
C₆H₅Cl₂ See *Benzene, dihalo-*.
C₆H₅Cl₂N₂O₂ Aniline, dichloronitro-, 642⁴, 829⁴.
C₆H₅Cl₂N₂O₃ Nitrobenzenediazonium tetrachloroiodide, 476⁴.
C₆H₅Cl₂N₂ Chlorobenzenediazonium tetrachloroiodide, 476⁴.
C₆H₅FeN₃ See *Ferrocyanide acid*.
C₆H₅I₂NO Benzene, 1-iodoxy-4-nitro-, 2935⁴.
C₆H₅I₂ Benzene, diiodo-, 3085⁴.
C₆H₅N₂O₂ Benzene, 1-nitro-4-nitroso-, 1699⁴.
C₆H₅N₂O₃ See *Benzene, dinitro-*.
C₆H₅N₂O₄ See *Phenol, dinitro-*.
C₆H₅N₂O₅ Hydroquinol, dinitro-, 599⁴.
C₆H₅O₂ See *Quinones*.
C₆H₅O₂ Quinone, 2-hydroxy-, 643⁴.
C₆H₅O₃ 2 - Furancarboxylic acid, 3 formyl-, 1139⁴.
C₆H₅O₃S₂ Malonic thioanhydride, 40⁴.
C₆H₅O₃ Comenic acid, 1277⁴, 1546¹.
C₆H₅O₃S₂ Quinonethiosulfonic acid, *K salt*, 514⁴.
C₆H₅AgN₂O₂ Hydroxylamine, β-nitroso-β-phenyl-, Ag salt, 123⁴.
C₆H₅AsCl₂ Arsenic, dichlorophenyl, *AlCl₃ addn. compd.*, 2323⁴.
C₆H₅AsN₂O₂ Benzenearsonic acid, 2 hydroxy-3,5-dinitro-, 2481⁴.
C₆H₅Br See *Benzene, bromo-*.
C₆H₅BrMg Phenylmagnesium bromide, 908⁴, 2907⁴, 2817⁴, 3268¹.
C₆H₅BrNO₂ Phenol, 2-amino-3,5-dibromo-, 2340⁴.
C₆H₅Cl See *Benzene, chloro-*.
C₆H₅Cl₂O₂S p - Sulfobenzenediazonium chloride, 2300⁴.
C₆H₅ClO Phenol, chloro-, 1362¹, 2937¹.
C₆H₅ClOS Benzenesulfinyl chloride, 1693⁴.
C₆H₅ClO₂ Eisholtzyl chloride, 1139⁴.
C₆H₅ClO₂S Benzenesulfonyl chloride, 1693⁴.
C₆H₅Cl₂S Benzenesulfonyl chloride, 1855⁴.
C₆H₅Cl₂HgN Aniline, 4 - chloro-, 2 - chloromercuri-, 502⁴.
C₆H₅Cl₂N Aniline, 2,5-dichloro-, 766⁴.
C₆H₅Cl₂NO Phenol, 2 - amino - 3,5 - dichloro-, 2340⁴.
C₆H₅Cl₂O₂ 2 - Furancarbinol, α-(trichloromethyl)-, 982¹.
C₆H₅Cl₄N₂ Benzenediazonium tetrachloroiodide, 476⁴.
C₆H₅F See *Benzene, fluoro-*.
C₆H₅I See *Benzene, iodo-*.
C₆H₅INO Ketone, 3,4-diiodo-2-pyrryl methyl-, 1421¹.
C₆H₅MoN₂O₂ Hydroxylamine, β-nitroso-β-phenyl-, molybdenum oxide compd., 1232⁴.
C₆H₅NO Benzene, nitroso-, 2037¹, 2191⁴, 2330¹.
C₆H₅NO₂ (See also *Benzene, nitro-*).
 Nicotinic acid, 2241⁷.
C₆H₅NO₂ (See also *Phenol, nitro-*).
 Nicotinic acid, hydroxy-, 69⁴, 72⁴.
 Pyruvic acid, α-keto-, 2493⁴.
C₆H₅NO₂ 2 - Furancarboxylic acid, 3-formyl-, oxime, 1139⁴.
 Hydroquinol, nitro-, 599⁴.
C₆H₅N₃ Benzene, triazo-, 1253⁴, 2340⁴, 2341⁴, 2649⁴.
C₆H₅N₂O₂ Picramic acid, 309¹.
C₆H₅ See *Benzene*.
C₆H₅AgN₂S 2 - Pyridinemercaptan, methyl-, Ag salt, 1278⁴.
C₆H₅AsNO₂ Benzenearsonic acid, 4-hydroxy-3-nitro-, P 2057⁷.
C₆H₅BrMgN Anilinemagnesium bromide, 1412⁴, 2807⁴.
C₆H₅BrNO Aniline, α-bromo-, 1411⁴.
C₆H₅BrNO Hydroxylamine, β-p-bromophenyl-, 1252⁴.
 Phenol, 2-amino-5-bromo-, 2340⁴.
C₆H₅BrN₂ Hydrazine, (dibromophenyl)-, 44⁴, 2936⁴.
C₆H₅Br₂ Cyclohexane, hexabromo-, 42⁴.
C₆H₅Cl₂HgNO Aniline, 4-chloro-2-hydroxymercuri-, 502⁴.
C₆H₅ClNO Aniline, chloro-, 49⁴, 766⁴, 2894¹.
 3 Picoline, 2 chloro-, and chloroplatinate, 518⁴.
C₆H₅ClNO Hydroxylamine, β-p-chlorophenyl-, 1252⁴.
 Phenol, 2 - amino - 5 - chloro-, and -HCl, 2340⁴.
C₆H₅GeO₂ Germanonic acid, phenyl-, 3259⁴.
C₆H₅I₂NO Pyrimine, 5-iodo-2-methoxy-, 1424¹.
C₆H₅N₂ Quinonediimine, 397⁴.
C₆H₅N₂O Isonicotinamide, 2954¹.
 Nicotinamide, 2954¹.
 Picolinamide, 2954¹.
C₆H₅N₂O₂ (See also *Aniline, nitro-*).
 Nicotinic acid, 2-amino-72⁴.
 o-Quinone, 4,5-diamino-, 2330⁴.
C₆H₅N₂O₂ Phenol, aminonitro-, 1877⁴.
 Pyridine, 1,2-methoxy-5-nitro-, 1424¹.
C₆H₅N₂O₃ 2,3 - Triazolecarboxylic acid, cyano-, ethyl ester, 2810⁴.
C₆H₅N₂O₃ Acetamide, α,α'-perthiobis[α-cyano-, 819⁴.
C₆H₅N₂O₃ Uric acid, methyl-, 816⁴, 1249⁴.
C₆H₅N₂O₄ 2,3,4,5 - Hexanetetrone, tetraoxime, diperoxide, 469⁴, 2187⁴.
 Phenylenediamine, 2,4 - dinitro-, 978⁴.

- C₆H₅O** See *Phenol*.
C₆H₅O See *Hydroquinol*, *Pyrocatechol*; *Resorcinol*.
C₆H₅O₃S Benzenesulfonic acid, *hydroxyammonium salt*, 1699.
C₆H₅O₃ (See also *Pyrogallol*.)
 1,2,4-Benzenetriol, 477, 30527.
 1,2 - Cyclopropanedicarboxylic anhydride, 1-methyl-, 1408.
 — *Isobutric acid, and salts*, 1139.
C₆H₅O₃S Benzenesulfonic acid, 980¹, 1681²; *salts*, 2482.
 Phenyl sulfite, *PhHSCl*, P 2060.
C₆H₅O₃ Muconic acid, 1249.
C₆H₅O₃S Phenolsulfonic acid, 480.
C₆H₅O₃S Hydroquinonethiosulfonic acid, 514.
C₆H₅O₃ Aconitic acid, *Na salt*, 1907.
 1,2,3 - Cyclopropanetricarboxylic acid, 246.
 Ketipic acid, 1560.
 Tartaric acid, dimethylene ester, 248.
C₆H₅O₃S Benzenedisulfonic acid, 980.
C₆H₅O₃ Bimalonic acid, *salts*, 1250¹, 1907.
C₆H₅AsCl₂NO Tris(β - chlorovinyl)hydroxy-
 arsonium nitrate, 3250.
C₆H₅AsNNaO₃ See *Atoxyl*.
C₆H₅BrN₂ Hydrazine, (p - bromophenyl)-, 1254.
C₆H₅BrN₂O Uracil, 5-bromo-3,6-dimethyl-, 1249.
C₆H₅N (See also *Aniline*.)
 Picoline, 518²; *chlorostannite*, 2668.
C₆H₅NNaO₃Sb See *Sibamine*.
C₆H₅NO (See also *Phenol, amino-*.)
 Hydroxylamine, β-phenyl-, 1252², 1412², 2305.
 Ketone, methyl 2-pyrryl-, 1421.
 Picolinol, 518²; *chloroplatinate*, 2342.
C₆H₅NO₂ Elsholtzamide, 1139.
C₆H₅NO₂S 5 - Thiazolecarboxylic acid, 2,4-dimethyl-, *and salts*, 1706.
C₆H₅NO₂S Sulfamic acid, 756.
C₆H₅NO₂ Nipectic acid, 3,5-dihydroxy-2 keto-
 γ-lactone, 635.
C₆H₅NO₂ Bimalonic acid, amino-, *tetra-K salt*, 1250.
C₆H₅NS 2 - Pyridinemercaptan, methyl-, *and derivs.*, 1279.
C₆H₅N₂O Hydrazine, (nitrophenyl)-, 1254.
 3-Picoline, 2-amino-5-nitro-, 518.
 —, 2-nitramino-, 518.
 Pyridine, 1,2 - dihydro - 1 - methyl - 2-nitroimino-, 1863.
C₆H₅N₂Sn, 3227.
C₆H₅N, Adenine, methyl-, 2090.
C₆H₅AlO See *Aluminium acetate*.
C₆H₅AsNO₃ Arsanilic acid, *salts*, 520.
C₆H₅AsNO Benzenearsenic acid, α-amino-hydroxy-, P 2210.
C₆H₅BrNO Nipectic acid, 3 - bromo - 5 - hydroxy - 2 - keto - 1 - methyl-, γ - lactone, 635.
C₆H₅BrO₄ Glutaric acid, α,β-dibromodimethyl-, 470.
 Succinic acid, α,β - dibromo-, di-Me ester, 246.
C₆H₅ClO₂ Adipyl chloride, 1400.
C₆H₅ClO₂S + *H₂O* δ-Glucose, 5,6-dichlorohydrin, 2,3-sulfate, 2480.
C₆H₅NO₂Sb *Na salt*—see *Sibamine*.
C₆H₅NS (See also *Hydrazine, phenyl*; *Phenylsulfonamide*.)
 Picoline, amino-, *and salts*, 518², 2954.
 Pyridine, 2-amino-3-methyl-, 1673.
 —, 1,2 - dihydro - 2 - imino - 1 - methyl-, *and chloroplatinate*, 1275¹, 1276.
C₆H₅N₂O Pyrazole, 1-acetyl-3-methyl-, 2953.
 Pyridine, 5-amino-2-methoxy-, 1424.
C₆H₅N₂O Imidazolepropionic acid, 1731.
 2,5 - Piperazinedione, 3 - methyl - (3 - methylene-, 3255.
 Pyrocatechol, 4,5 - diamino-, di-HCl, 2330.
 Uracil, dimethyl-, 1249², 2055.
C₆H₅N₂O Barbituric acid, 5-ethyl-, 2641.
 Imidazolelactic acid, 2972.
 Isobarbituric acid, 1,3-dimethyl-, 1249.
 4 - Pyridazinecarboxylic acid, 2,3,4,5 - tetrahydro - 3 - keto - 6 - methyl-, 3480.
C₆H₅N₂O Isodialuric acid, 1,3-dimethyl-, 1249.
C₆H₅N₂O 1,2,3,6 - Dioxiazine, 4,5 - diacetyl-, dioxime, 469.
C₆H₅O 2-Butin-1-ol, acetate, 1696.
C₆H₅O Glucal, 10057.
C₆H₅O 1,2 - Cyclobutanedicarboxylic acid, 474.
 1,2 - Cyclopropanedicarboxylic acid, 1-methyl-, *and Ca salt*, 1408.
 Fumaric acid, di-Me ester, 3263²; *SnCl₄ addn. compd.*, 509.
 Glutaric acid, α-hydroxy-α (and γ)-methyl-, γ-lactone, *and salts*, 1408.
 Isobutyric acid, β,β' - diformyl-, 1129.
 Lactic acid, 2091², 3082.
 Malic acid, di-Me ester, 2932¹, 3263²; *SnCl₄ addn. compd.*, 509.
C₆H₅O Malonic acid, acetonyl-, 3480.
C₆H₅O 1,3 - Dioxolan - 2 - one, 4 - (hydroxymethyl)-, bicarbonate, Me ester, 468.
C₆H₅O₃S Cyclohexenesulfonic acid, dihydroxy-keto-, *Na salt*, 479.
C₆H₅O (See also *Citric acid*.)
 2,5 - Anhydroidosaccharic acid, 2189.
 2,5 - Anhydromannosaccharic acid, 2189.
 2,5 - Anhydromucic acid, 2189.
 2,5 - Anhydrosaccharic acid, 2189.
 Isocitric acid, 1150.
C₆H₅O Tricarballic acid, trihydroxy-(?), 2609.
C₆H₅Ag₃N₃ Silver tricyanomelamine, 3228.
C₆H₅AsCl₂ Arsine, bis(β-chlorovinyl)ethyl-, 3250.
C₆H₅ClN₂ Pyrazole, chloro - 1 - ethylmethyl-, *and perchlorate*, 2952.
CFT₂ClN₂O Glycine, N - (aminocyanamino-methylene) - (?), chloroacetate, 2052.
 5 - Oxazolidone, 2 - amino - 2 - cyanamino-(?), chloroacetate, 2052.
C₆H₅ClO Cyclohexane, 1-chloro-1,2-epoxy-, 2031.
 β - Pentenyl chloride, β - methyl-, 1695.
C₆H₅ClO₂ Crotonic acid, β-chloro-, ethyl ester, 3057.
 Isocrotonic acid, β-chloro-, ethyl ester, 3057.
C₆H₅Cl₂O₃ Trioxane, 2,4 - dimethyl - 6 - (trichloromethyl)-, 242.
C₆H₅Cl₂O₄ Acetic acid, trichloro-, AcOEt addn. compd., 3252.
C₆H₅CuK₂O + *H₂O*, 2609.
C₆H₅Mo₂NO Methylpyridinium molybdate, 2191.
 Phenylammonium molybdate, 2491.
C₆H₅NO Methylpyridinium hydroxide, 1014.
C₆H₅NO Cyclopropanecarboxamide, 1-acetyl-, 2809.
C₆H₅NO Propionitrile, β-carboxyoxo-, Et ester, 2039.
C₆H₅NO Alanine, N-pyruvyl-, 3255.

- $C_6H_5NO_3S$ Benzenesulfonic acid, NH_4OH salt, 292⁹.
- $C_6H_7NO_3S$ 1 - Phenol - 4 - sulfonic acid, NH_4OH salt, 324⁹.
- $C_6H_7NO_3$ Acetic acid, nitrilotris-, P 2111⁶; *Na* V salt, P 380¹.
- $C_6H_7N_2O_2$ (See also *Histidine*.)
Cupferron, 1232⁷.
- $C_6H_7N_2O_2$ 4 - Imidazolecarboxamide, tetrahydro - 2,5 - diketo - *N* - dimethyl-, 2811⁴.
- $C_6H_7N_2O_4$ Isocaffuric acid, 2811⁴.
- C_6H_{10} (See also *Cyclohexene*.)
Biallyl, 1401⁴.
Hexine, 3276⁴.
- $C_6H_{10}AsCl_2I$ Bis(β - chlorovinyl)dimethylarsonium iodide, 3250⁷.
- $C_6H_{10}BiNO_3$ Fructose bismuth nitrate, 1545⁴.
Mannose bismuth nitrate, 1545⁴.
- $C_6H_{10}BrNO_2$ Butyric acid, α -bromo- α -nitro-, Et ester, 2027⁷.
- $C_6H_{10}Br_2O_2$ Caproic acid, α , ϵ -dibromo-, 471⁴.
- $C_6H_{10}CdO_2S$ Cadmium xanthate, 2459¹.
- $C_6H_{10}ClNO_2$ Butyric acid, α -chloro- α -nitro, Et ester, 2027⁷.
- $C_6H_{10}Cl_2O_4$ *d*-Glucose, 5,6-chlorohydrin, 2479⁹, 2480¹.
- $C_6H_{10}IN_2O_2$ Imidazole, dimethylnitro-, methiodide, 3271⁴.
- $C_6H_{10}I_2S_3$ Pentasulfide, bis(β , γ -diiodopropyl), 464⁴.
- $C_6H_{10}MoO_3S_4$ Molybdenum xanthate, 2459¹.
- $C_6H_{10}N_2O_2$ 1,2-Cyclohexanedione, dioxime, 487².
2,5-Piperazinedione, dimethyl-, 995⁴, 2033¹.
- $C_6H_{10}N_2O_3$ 2,5 - Piperazinedione, 3 - hydroxymethyl-6-methyl-, 80².
- $C_6H_{10}N_2O_4$ Formic acid, azobis-, di-Et ester, 2499¹.
- $C_6H_{10}N_2Sn$, 3227⁴.
- $C_6H_{10}N_2O_4$ 4 - Pyridazinecarboxylic acid, 2,3,4,5 - tetrahydro - 3 - keto - 6 - methyl-, hydrazide, 3480⁴.
- $C_6H_{10}O$ Δ^1 -Cyclohexenol, 1857⁷.
 Δ^1 -2-Hexenone, 1401⁴.
Ketene, diethyl-, 1226⁴, 2658⁹.
Mesityl oxide, 609⁷, 1401⁴, 1662³, 2666⁷.
- $C_6H_{10}O_2$ Cyclopentanecarboxylic acid, 1802⁴.
Pentenic acid, methyl-, 1423³, 1695⁴, 3251⁴.
 Δ^1 -3-Pentenol, formate, 2331⁷.
- $C_6H_{10}O_3$ (See also ethyl ester under *Acetoacetic acid*.)
Acid, m. 81-2°, from cyclodecaheptiscyclobutanedione and H_2O_2 , 1409².
Levulinic acid, α -methyl-, 3480⁷.
- $C_6H_{10}O_3S_2$ Xanthopropionic acid, and *Na* salts, 1245⁴.
- $C_6H_{10}O_4$ Adipic acid, 3252³; *Na* salt, 1166¹.
Glutaric acid, β -methyl-, 1802⁴.
Lactic acid, Me est⁴, acetate, 244⁴.
Oxalic acid, di-Et ester, 2931⁴.
Pseudoglucal, 2478⁴.
- $C_6H_{10}O_5S$ Propionic acid, α , α' -thiobis-, 923⁴.
- $C_6H_{10}O_5S_2$ Acetic acid, ethylenedithiobis-, complex salts, 3253⁴, 3254⁴.
- $C_6H_{10}O_6$ Dilactic acid, 3091⁴, 3082⁴.
Dioximethylene, dicetate, 1245⁴.
Glucosan, 41⁴, 2662⁷.
Glutaric acid, α - hydroxy - α (and γ) - methyl-, and salts, 1408⁹.
Lactic acid, lactate, 2091⁴, 3082⁷.
- ($C_6H_{10}O_6$)_n See *Cellulose*; *Lichenin*; *Starch*.
- $C_6H_{10}O_8$ Adipic acid, β , γ -dihydroxy-, 1249².
Glycol, dibicarbonate, di-Me ester, 467⁴.
- Succinic acid, α , β -dimethoxy-, 248⁴.
- $C_6H_{10}O_7$ See *Glucuron* acid.
- $C_6H_{10}O_8$ Allomucic acid, 3256⁴.
Mannosaccharic acid, 3256⁴.
Mucic acid, 1166¹, 2640⁹, 3266⁴; *Na* salt, 1907⁴.
Saccharic acid, 3256⁴.
- $C_6H_{10}O_8S_2$ Cyclohexenesulfonic acid, tetrahydroxy-, acid salt, di-*Na* salt, 47⁴.
- $C_6H_{10}S_3$ Pentasulfide, diallyl, 464⁴.
- $C_6H_{11}BrN_2O_2$ (See also *Bromural*.)
Malonamide, α -bromo-*N*-isopropyl-, 1696⁹.
- $C_6H_{11}BrO_2$ Caproic acid, ϵ -bromo-, 471⁴.
Ethylene, bromodithio-, 3248⁴.
- $C_6H_{11}BrNO$ Butyramide, α , β - dibromo - α -ethyl-, 1129⁹.
- $C_6H_{11}ClNO_2$ Compd., decomps. 160-1°, from Me ester of glycylserine and $SOCl_2$, -HCl, 638⁴.
- $C_6H_{11}ClO$ Ethylene oxide, α - (α - chloroethyl)- β -ethyl-, 2414⁴.
- $C_6H_{11}ClO_2S$ Cyclohexanesulfonyl chloride, 1402⁷.
- $C_6H_{11}ClO_3Ti_2$, 1671⁴.
- $C_6H_{11}NO$ Butyronitrile, γ -ethoxy-, 469⁴.
Crotonamide, α -ethyl-, 1129⁹.
Pentanamide, β -methyl-, 1695⁴.
- $C_6H_{11}NO_2$ Crotonic acid, β -amino-, Et ester, 2451⁷.
Hygic acid, and *Cu* salt, 2825⁴.
- $C_6H_{11}NO_3$ Acetohydroxamic acid, ethoxy-, acetate, and *K* salt, 240⁹.
Propionohydroxamic acid, β -methoxy-, acetate, and *K* salt, 240⁹.
- $C_6H_{11}NS_2$ 1 - Piperidinecarboxylic acid, dithio-, salts, 973⁴.
- $C_6H_{11}N_2O_4$ Tricarballylamide, trihydroxy-(?); 200⁹.
- $C_6H_{11}Na_2O_4$, 1946¹.
- C_6H_{12} (See also *Cyclohexane*.)
2-Butene, dimethyl-, 1401⁴, 1855².
- $C_6H_{12}BaCl_2O_2$, 3071¹.
- $C_6H_{12}BiNO_3$, 1545⁴.
- $C_6H_{12}BiHgO_2S_2$ Compd. from (C_6H_5)₂S₂ in EtOH-HgCl₂, 967⁴.
- $C_6H_{12}ClO_3$ 3-Hexanol, 4,5-dichloro-, 241⁴.
- $C_6H_{12}HgOS_2$ Xanthic acid, propylmercuric deriv., 465⁴.
- $C_6H_{12}N_2$ Δ^2 - Pyrazoline, 5 - ethyl - 4 - methyl-, 2606⁷.
—, 3,5,5-trimethyl-, 2666⁴.
- $C_6H_{12}N_2O_2$ Malonamide, *N*-isopropyl-, 1696⁹.
Succinamide, α , α -dimethyl-, 268⁷.
- $C_6H_{12}N_2O_3$ Propionamide, α - lactylamino-, 470⁴.
Sarcosine, *N*-sarcosyl-, 1128⁹.
- $C_6H_{12}N_2O_3S_2$ See *Cystine*.
- $C_6H_{12}N_4$ See *Hexamethylethylenetetramine*.
- $C_6H_{12}O$ (See also *Cyclohexanol*.)
Ethylene oxide, s -diethyl-, 1651⁴.
 Δ^1 -3-Hexenol, 2331⁷.
Pinacol, 2187¹.
- $C_6H_{12}O_2$ Butyric acid, α -ethyl-, 1802⁴.
Butyric acid, Et ester, 2221⁴.
Caproic acid, 668⁷, 1079⁹, 3251⁴.
Cyclohexanediol, 1857⁴.
Isocaproic acid, 3251⁴.
Isovaleric acid, α -methyl-, 3251⁴.
2-Pentanone, 4-hydroxy-4-methyl-, 1823⁹.
Valeric acid, α -methyl-, 3251⁴.
- $C_6H_{12}O_3S$ Cyclohexanesulfonic acid, 467⁴.
- $C_6H_{12}O_4$ (See also *Methylololol*; *Paraldehyde*.)
Caproic acid, ϵ -hydroxy-, and *Na* salt, 471⁴.
Methanol, s -sec-butyloxy-, formate, 2930⁴.

- Methanol, isopropoxy-, acetate, 2930⁴.
 Propionic acid, ethoxymethyl ester, 2930⁴.
 C₂H₁₀O₃S Cyclohexanesulfonic acid, *salts*, 1402⁹.
 C₂H₁₀O₄ Glycolic acid, ethoxy-, Et ester, 1992⁵.
 Pseudoglucose, dihydro-, 2478⁴.
 C₂H₁₀O₄S, 1867⁴.
 C₂H₁₀O₄ Arabinoside, methyl-, 639⁹, 1409⁹.
 Glucodesose, 1005⁷.
 Rhamnose, 3097⁹.
 Xyloside, methyl-, 639⁹.
 C₂H₁₀O₄ (See also *Chitose*; *Fructose*; *Galactose*; *Glucose*; *d-Glucose*; *Inositol*; *Mannose*.)
 Sorbose, 1698².
 C₂H₁₀O₇ Galactonic acid, 3250⁴.
 Gluconic acid, 1878¹, 2355⁴.
 Gulonic acid, 3256⁴.
 Hexonic acid, and *salts*, 260⁹.
 Mannonic acid, 3256⁴.
 C₂H₁₀O₈S Triethylene tetrasulfide, tetrakis(S-dioxide), and *derivs.*, 2180⁹.
 C₂H₁₀S₃ Triethylene trisulfide, 2027¹.
 C₂H₁₀S₄ Triethylene tetrasulfide, 2186⁴.
 C₂H₁₀ClO 3-Hexanol, 5-chloro-, 241⁷.
 C₂H₁₀N Cyclohexylamine, 2590¹.
 C₂H₁₀NO Diacetanamine, 1404².
 2 - Propagone, 1 - (ethylmethylamino)-, 511¹.
 C₂H₁₀NO₂ (See also *Leucine*.)
 Carbonimidic acid, Et Pr ester, 970¹.
 Isoleucine, 662⁹.
 C₂H₁₀NO₃S Cyclohexanesulfonamide, 1402⁹.
 C₂H₁₀NO₃ Oximidocarbonic acid, Et Pr ester, 970¹.
 C₂H₁₀NO₄ Valeric acid, α,γ -dihydroxy- β -methyl-amino-, 635⁴.
 C₂H₁₀NO₄ Galactosamine, 1560⁴.
 Glucosamine, 623¹, 2672¹; -HCl, 1715¹.
 C₂H₁₀NO₄ Galactosaminic acid, 1560⁴.
 C₂H₁₀N₂O Glycine, [N - (N - alanyl)glycyl]-, 2503⁷.
 C₂H₁₀N₂O₂ Hydrazine, (β - aminoethyl)-, di-oxalate, 3250².
 C₂H₁₀O₃P Glucosephosphoric acid, *Ba salt*, 2311¹, 2812¹.
 C₂H₁₀ (See also *Hexane*.)
 Butane, 2,3 dimethyl-, 1073¹, 2258¹.
 C₂H₁₀ClTi Diisopropylthallic chloride, 3439⁹.
 C₂H₁₀INO₂ Hydroxymethyltrimethylammonium iodide, acetate, 1913².
 C₂H₁₀Mo₂O₁₂ Dimolybdo-mannitol, 1545⁹.
 C₂H₁₀NO₃TI Diisopropylthallic nitrate, 3439⁹.
 C₂H₁₀N₂ Propane, 2,2'-azobis-, *CuCl addn. compd.*, 2499².
 C₂H₁₀N₂O 2 - Piperazinecarbinol, 5-methyl-, 80¹.
 C₂H₁₀N₂O₂ See *Lysine*.
 C₂H₁₀N₂O₂ Lysine, β hydroxy-, 2347⁹.
 C₂H₁₀N₂O₂ Hydrazine, isobutyl-, oxalate, 3478⁹.
 C₂H₁₀N₂O₂ See *Arginine*.
 C₂H₁₀O 2-Pentanol, 2-methyl-, 1823⁹.
 Propyl ether, 1693⁷.
 C₂H₁₀O₂ Acetal, 1556⁷.
 Butyraldehyde, dimethylacetal, 1694¹.
 1,2-Cyclohexanediol, 979⁹.
 C₂H₁₀O₂ Ether, bis(β -methoxyethyl), 634¹.
 2,3,4-Hexanetriol, 2329⁹.
 C₂H₁₀O₂ (See also *Mannitol*.)
 Dulcitol, 2712⁴, 3418⁴.
 Sorbitol, 3131¹, 3418⁴.
 C₂H₁₀O₂P₂ Hexosephosphoric acid, 85⁹.
 Sulfide, propyl sulfide, 3469⁹.
 Sulfide, butyl ethyl-, 1850⁹.
 C₂H₁₀AlO₃ Aluminium ethoxide, 1247¹, 2807¹, 3251¹.
 C₂H₁₀BO₃ Mannitol boric acid, 2178⁹.
 C₂H₁₀BrS Triethylsulfonium bromide, 1913¹.
 C₂H₁₀Br₂N₃S Triazine, hexahydro-1,3,5-trimethyl-, dibromide, 538⁹.
 C₂H₁₀N Dipropylamine, -H₂, 1408⁹.
 Triethylamine, 1409¹, 1855¹, 2895⁴.
 C₂H₁₀NO Hydroxylamine, butylethyl-, 2786⁴.
 3-Pentanol, 3-(amidomethyl)-, 635⁷.
 C₂H₁₀N₂ Guanidine, pentamethyl-, 1909⁴.
 C₂H₁₀O₂P Ethyl phosphates, EtPO₄, 2927⁴.
 C₂H₁₀P Phosphine, triethyl-, 2323¹.
 C₂H₁₀ClNO Butoxyethylammonium chloride, 2180².
 Butylethoxyammonium chloride, 2180².
 C₂H₁₀FeN₂O₂S₂, 1802¹.
 C₂H₁₀IN Dipropylammonium triiodide, 1403⁴.
 C₂H₁₀CoN₂O₂S₂Se, 617¹.
 C₂H₁₀Mo₂NO₁₂ Dimolybdo-mannitol, NH₄ salt, 1545⁹.
 C₂H₁₀NO₂ See *Neosine*.
 C₂H₁₀OnP₅ Inositolpentaphosphoric acid, *Cu and Pb salts*, 94¹.
 C₂H₁₀Cl₂Pd₂Br₂, 1107¹.
 C₂H₁₀Cl₂PtSb₂, 1107¹.
 C₂H₁₀N₂ Triethylaniline, β,β',β'' - triamino-, *salts*, 3480⁹.
 C₂H₁₀N₂S₂ Stannopropane, disodiumhexamethyl-, 3250⁹.
 C₂H₁₀OS₂ Oxide, bis(trimethylstannyl)(?), 2928⁹.
 C₂H₁₀O₂Si₂ Silicic oxide, hexamethoxy-, 19⁴.
 C₂H₁₀OnP₄ Phytic acid and *Ba salt*, 1135¹.
 C₂H₁₀S₂N₂ Sulfide, bis(trimethylstannyl), 2928⁹.
 C₂H₁₀BrOS₂ + H₂O, *Compd.* from MeSnOH and MeSnBr, 2929⁹.
 C₂H₁₀ClOS₂ + H₂O *Compd.* from MeSnOH and MeSnCl, 2929⁹.
 C₂H₁₀IOS₂ + H₂O *Compd.* from MeSnOH and MeSnI, 2929⁹.
 C₂H₁₀Cl₂CoN₂O₂ + H₂O, 68¹.
 C₂H₁₀Co₂N₂O₂, 68¹.
 C₂H₁₀CoN₂O₂S₂, 68¹.
 C₂H₁₀N₂O₂Si₂ Siloxene, tri[ethylamino]-, 618⁹.
 C₂H₁₀ClCo₂N₂, 68¹.
 C₂H₁₀Cl₂CoN₂ + H₂O, 68¹.
 C₂H₁₀CdCl₂N₂O₂, 21¹.
 C₂H₁₀ClMoN₂O₂, 3449¹.
 C₂H₁₀N₂O₂W₂ + 2H₂O Methylammonium tungstate, 2191¹.
 C₂I₂ Benzene, hexaiodo-, 754⁹.
 C₂K₂O₂Sb + 2H₂O Potassium antimonoxalate, 3069⁹.
 C₂Mo₂O₁₂ + 12H₂O, 2600⁴.
 C₂N₂Na₂ + 3H₂O Sodium tricyanomelamine, 3228¹.
 C₂N₂O₂ Quinone, tetraiso-, 644⁴.
 C₂H₂Cl₂N₂O₂ Benzoyl azide, 4-chloro-3,5-dinitro-, 2824¹.
 C₂H₂Cl₂N₂O₂ Benzoyl chloride, 4-chloro-3,5-dinitro-, 2824¹.
 C₂H₂Cl₃N₂O₂ Toluene, 4-trichloro-2,4,6-trinitro-, 2037¹.
 C₂H₂Br₂N₂O₂ Benzonitrile, 2-bromo-5-nitro-, 819¹.
 C₂H₂Br₂NOS 2,3 - Pyridothienophen - 3(2) - one, 2,2 - dibromo-, and *derivs.*, 1278¹.
 C₂H₂Br₂N₂ Indazole, 3,5,7 tribromo-, 512⁹.
 C₂H₂Cl₂N₂O₂ Benzonitrile, 2-chloro-5-nitro-, 819¹.
 C₂H₂Cl₂N₂O₂ Lutidyl chloride, 2844¹.
 C₂H₂Cl₂N₂O₂ Toluene, α ,2,3,4 - tetrachloro-6-nitro-, 2637¹.
 C₂H₂Cl₂N₂O₂ Anisole, 2,3,5,6 - tetrachloro-4-nitro-, 3453¹.
 C₂H₂AgNO₂ Benzaldehyde, hydroxynitro-, Ag salt, 2040².

- C₇H₇AsClO₂** Arsinous anhydride, *o*-carboxyphenylchloro-, 4797.
C₇H₇Br₂ClNS Benzothiazole, 1-chloro-, dibromide, 2666.
C₇H₇Br₂N₂ Indazole, 5,7-dibromo-, 512.
C₇H₇Br₂N₂O 1,4-Imidazopyridin-2(3)-one, 6,8-dibromo-, and chloroplatinate, 1275, 1276.
C₇H₇Br₂N₂O₂ Cresol, dibromodinitro-, 1700.
C₇H₇Br₂O₂ Benzoic acid, 2,6-dibromo-, 1259.
C₇H₇Br₂ClNO Salicylaldehyde, 3,5-dibromo-, 259.
C₇H₇ClNO Phenol, *m*-nitro-, chloroformate, 3269.
C₇H₇ClN₂O₂ Benzamide, 4-chloro-3,5-dinitro-, 2824.
C₇H₇ClN₂O Toluene, α -chloro-2,4,6-trinitro-, 2037.
C₇H₇ClO₂P Salicyl chloride, (*O*-phosphoryl-, 51.
C₇H₇Cl₂NNaO₂S See *Pantosept*.
C₇H₇Cl₂O Phenol, chloro-, chloroformate, 3269.
C₇H₇HgNNaO₂S Saccharin, mono-Hg compd., Na salt, 1247.
C₇H₇HgNNaO₂S Saccharin, di-Hg compd., Na salt, 1247.
C₇H₇HgNNaO₂S Saccharin, tri-Hg compd., Na salt, 1247.
C₇H₇NNaO₂S Crystalline-, 3408.
C₇H₇N₂O₂ Benzonitrile, *f*-nitro-, 2948.
C₇H₇N₂O Benzonitrile, 3-hydroxy-4-nitro-, 2310.
C₇H₇N₂O Benzoic acid, dinitro-, Na salt, 1520.
C₇H₇O₂ Chelidonic acid, 1277.
C₇H₇O₂ Mecouic acid, 1277, 1546, 2380.
C₇H₇AsO₂ + H₂O Benzoic acid, *o*-arsinose-, 479.
C₇H₇BrO Benzoyl bromide, 2640.
C₇H₇BrO₂ Benzaldehyde, 2 and 4-bromo-4-hydroxy-, 2040.
C₇H₇BrO₂ Benzoic acid, bromo-, 2330.
C₇H₇Br₂NO₂ Anthranic acid, 4,5-dibromo-, 3262.
C₇H₇Br₂NO₂ Benzaldehyde, 2,4-dibromo-5-hydroxy-, oxime, 2040.
C₇H₇Br₂N₂O₂ Aniline, 2,6-dibromo-*N*-methyl-, 4-dinitro-, 1265.
C₇H₇Br₂O *p*-Cresol, 2,3,5-tribromo-, 1700.
C₇H₇ClN₂O₂ Benzaldehyde, 2-chloro-5-nitro-, oxime, 2650.
C₇H₇ClO (See also *Benzoyl chloride*.)
C₇H₇ClO Benzaldehyde, chloro-, 3261.
C₇H₇ClO₂ Benzoic acid, *p*-chloro-, salt, 2840.
C₇H₇Cl₂NO₂S Na salt, see *Pantosept*.
C₇H₇Cl₂O Benzoic acid, 4-hydroxy-2-iodo-, 640.
C₇H₇Cl₂O Benzoic acid, 2-iodo-, 2814.
C₇H₇LiNO₂ Anthranic acid, 3,5-dinitro-, 506.
C₇H₇N (See also *Benzonitrile*.)
C₇H₇N Benzene, isocyanic acid, Ph ester, 3085.
C₇H₇NO Isocyanic acid, Ph ester, 3085.
C₇H₇NO₂ 2,3-Pyridothienophene-3-ol, 1278.
C₇H₇NO₂ Benzaldehyde, nitro-, P 77, 822, 1644, 2068.
C₇H₇NO₂ Benzoic acid, *o*-nitroso-, 1537.
C₇H₇NO₂S See *Saccharin*.
C₇H₇NO₂ Benzoic acid, nitro-, 1233, P 2841, salt, 2810.
C₇H₇NS Benzothiazole, 733, and deriv., 667.
C₇H₇NS Benzothiazole, 1-mercapto-, 66.
C₇H₇NNaO₂ 7-Isa-1,7-pyrrolopyridin-3-ol(?), Na deriv., 281.
C₇H₇NNaO₂ 1,7-Pyrrolopyridin-3-ol(?), Na deriv., 281.
C₇H₇NNaO₂ *o*-Cresol, dinitro-, Na salt, 1133.
C₇H₇N₂ Pyridopyrazine, and chloroplatinate, 708.
C₇H₇N₂O Benzoyl azide, 1253.
C₇H₇N₂O 2,4,5-Pyridopyrimidin-5-ol, 72.
C₇H₇N₂O Anthranilnitrile, 5-nitro-, 819.
C₇H₇N₂O 1,4-Imidazopyridine-2,3-dione, oxime, and chloroplatinate, 1275, 1276.
C₇H₇N₂O₂ (See also *Toluene, trinitro-*.)
C₇H₇N₂O₂ Quinone, 2-hydroxymethyl-5-nitro-3-nitroso-, 1-oxime, 2037.
C₇H₇N₂O₂ Quinone, 3-hydroxymethyl-6-nitro-4-nitroso-, 2-oxime, 2037.
C₇H₇N₂O₂ Anisole, 2,4,6-trinitro-, 1700.
C₇H₇N₂O₂ *m*-Cresol, trinitro-, P 1033, 2565.
C₇H₇N₂O₂ Aniline, *N*-methyl-2,4,6-trinitro-*N*-nitroso-, P 300.
C₇H₇N₂O₂ Tetryl, P 733, 1053.
C₇H₇AsNO₂ Benzoxazolinearsonic acid, 1-keto-, P 2210, 2390.
C₇H₇AsNO₂ Benzoic acid, arsononitro-, 479.
C₇H₇BrNO₂ Benzaldehyde, bromohydroxy-, oxime, 2040.
C₇H₇BrNO₂ Benzoic acid, 4-amino-2-bromo-, salt, 2382.
C₇H₇Br₂O *p*-Cresol, 5-bromo-2-nitro-, 981.
C₇H₇Br₂O *p*-Cresol, dibromo-, 981, 1259.
C₇H₇Br₂O₂ Benzyl alcohol, 2,6-dibromo-4-hydroxy-, 1700.
C₇H₇Br₂O₂ Orcinol, 2,4-dibromo-, 1260.
C₇H₇ClNO *p*-Manilide, *N*-chloro-, 1132.
C₇H₇ClNO₂ *o*-Cresol, 6-chloro-4-nitroso-, 271.
C₇H₇ClNO₂ Phenol, *o*-chloro-, carbamate, 3269.
C₇H₇ClNO₂ Toluene, α -chloro-*p*-nitro-, 766, 1980.
C₇H₇ClNO₂ Anisole, 3-chloro-2-nitro-, 2937.
C₇H₇ClNO₂ Carbamic acid, hydroxy-, chlorophenyl ester, 3258.
C₇H₇ClNO₂ *o*-Cresol, chloronitro-, 2340, P 3491.
C₇H₇Cl₂O Toluene, α , α -dichloro-, 1700.
C₇H₇Cl₂OS Sulfone, 2,5-dichlorophenyl methyl-, 1133.
C₇H₇I₂NO₂ Benzoic acid, 4-amino-2-iodo-, and -HCl, 646.
C₇H₇I₂NO Ketone, ethyl 3,4,5-triiodo-2-pyrryl-, 1421.
C₇H₇NNaO + H₂O Benzaldehyde, oxime, Na salt, 2475.
C₇H₇NNaO₂ *o*-Cresol, nitro-, Na salt, 1133.
C₇H₇N₂O Benzimidazole, 733.
C₇H₇N₂O Indazole, 511, 733.
C₇H₇N₂O Benzonitrile, 4-amino-3-hydroxy-, 2340.
C₇H₇N₂O 1,4-Imidazopyrimidine, 653, and salts, 1275, 1276.
C₇H₇N₂O 3-Indazolol, and -HCl, 2050.
C₇H₇N₂O 3-Isoumdazolol, and -HCl, 2050.
C₇H₇N₂O 7-Isa-1,7-pyrrolopyridin-3-ol(?), -HCl, 281.
C₇H₇N₂O 1,7-Pyrrolopyridin-3-ol(?), -HCl, 281.
C₇H₇N₂O (See also *Toluene, dinitro-*.)
C₇H₇N₂O Anthranic acid, nitro-, 3262.
C₇H₇N₂O Benzaldehyde, hydroxynitro-, oxime, 2040, 2331, 2340.
C₇H₇N₂O Benzyl alcohol, 4-hydroxy-2,6-dinitroso-, 2037.
C₇H₇N₂O Duplicolic acid, 4-amino-, and deriv., 704.
C₇H₇N₂O Phenol, *m*-nitro-, carbamate, 3269.
C₇H₇N₂O₂ Anisole, 2,4-dinitro-, 1700.
C₇H₇N₂O₂ Carbamic acid, hydroxy-, *m*-nitrophenyl ester, 3258.
C₇H₇N₂O₂ *o*-Cresol, 4,6-dinitro-, 1132.
C₇H₇N₂O₂ Toluene-sulfonic acid, dinitro-, Na salt, 479.
C₇H₇N₂O₂ Benzamide, 4-amino-3,5-dinitro-, 2824.

- C₇H₆O** See *Benzaldehyde*.
C₇H₆O₂ (See also *Benzoic acid*.)
 Benzaldehyde, *m*-hydroxy-, 3040¹, P 3490¹.
 2-Furanal, plain, 1138⁹.
 Salicylaldehyde, 868⁹, 1471¹, 2810⁹, P 3490¹.
 p-Tolquinone, 2649¹.
C₇H₆O₃ Benzoic acid, *p*-mercapto-, 2195¹.
C₇H₆O₄ (See also *Salicylic acid*.)
 Benzoic acid, hydroxy-, 51⁹, 1265⁷, 3483¹; salts, 2816¹.
 2-Furanacrylic acid, 2475⁴.
 Maleic anhydride, α -methyl- β -vinyl-, 2809².
 Perbenzoic acid, 1360⁹, 2419⁹, 2650⁴.
C₇H₆O₄ Pyrocatechuic acid, 2620⁴.
 Resorcylic acid, 1377¹.
C₇H₆O₅ Gallic acid, 2197¹.
C₇H₆O₆ Benzoic acid, *o*-sulfo-, salts, 1090⁹.
C₇H₆O₇ Tricarballic acid, α,γ -anhydride, β -(hydroxymethoxy)-, lactone, 3255⁹.
C₇H₆O₈ Salicylic acid, sulfo-, 1007⁹.
C₇H₆O₉ *p*-Benzenedisulfonic acid, 2-formyl-, P 1575⁹.
C₇H₆O₁₀ 1,1,2,3 - Cyclopropanetetra-carboxylic acid, 264⁴.
C₇H₇AsO₂ Benzoic acid, arsono-, 479⁹.
C₇H₇AsO₃ Benzoic acid, arsonohydroxy-, 479¹ & 4.
C₇H₇Br Toluene, bromo-, 474⁹.
C₇H₇BrMg Benzylmagnesium bromide, 2817⁹.
C₇H₇BrMg *p*-Tolylmagnesium bromide, 2654⁹.
C₇H₇BrMgO *p* - Anisylmagnesium bromide, 2654⁹.
C₇H₇BrN₂O Acetamide, α -bromo-*N*-2-pyridyl-, 1276¹.
 Aniline, *p*-bromo-*N*-methyl-*N*-nitroso-, 45¹.
C₇H₇BrN₂O₂ Theobromine, 8-bromo-, 2345¹.
C₇H₇BrO *m*-Cresol, 2-bromo-, 1413⁹.
C₇H₇BrO₂ Sulfone, *m*-bromophenyl methyl-, 2647⁹.
C₇H₇BrO₃ Maleic anhydride, α -(β -bromoethyl)- β -methyl-, 2809².
C₇H₇BrHgN *m*-Toluidine, bis(bromomercuri)-, 49⁹, 50¹.
C₇H₇BrN *o*-Toluidine, 4,6-dibromo-, salts, 2646⁹.
C₇H₇BrNO *o*-Anisidine, 4,6-dibromo-, 2193².
C₇H₇Cl See *Toluene, chloro*-.
C₇H₇ClN₂O₂ See *Chloramine-T*.
C₇H₇ClN₂ *o*-Toluenediazonium chloride, *PbCl₂* double salt, 470⁹.
C₇H₇ClN₂O Acetamide, α -chloro-*N*-2-pyridyl-, 1236¹.
 Pyridine, 1-chloroacetyl-, 1,2-dihydro-2-imino-, and -HCl, 653⁹.
C₇H₇ClN₂O₂ *m*-Anisidine, 6-chloro-4-nitro-, 820⁹.
C₇H₇ClN₂O₃ Paraxanthine, 8-chloro-, 2345¹.
 Theophylline, 8-chloro-, 2345¹.
C₇H₇ClO *o*-Cresol, chloro-, 270⁹, 2340⁹.
C₇H₇ClO₂ Sulfone, *p*-chlorophenyl methyl-, 1133¹.
 p-Toluenesulfonyl chloride, 980⁹, 1093⁹.
C₇H₇ClO₃ Benzenesulfonyl chloride, *m*-(methylsulfonyl)-, 2647⁹.
C₇H₇Cl₂ *p*-Toluenesulfonyl chloride, 1865⁹.
C₇H₇Cl₂HgN *m*-Toluidine, bis(chloromercuri)-, 49⁹, 50¹.
C₇H₇Cl₂N₂O₂ Dichloramine-T, 267⁹, 1474¹.
C₇H₇Cl₂OP₂ Thiophosphoryl dichloride, *p*-tolyl ester, 2325⁷.
C₇H₇Cl₃N₂ Toluenediazonium tetrachloroiodide, 476⁹.
C₇H₇CrNO₂, 3071¹.
C₇H₇F Toluene, fluoro-, 2781¹.
C₇H₇I Toluene, *o*-iodo-, 2815⁹.
C₇H₇I₂NO Ketone, ethyl 3,4-diiodo-2-pyrryl-, 1421¹.
C₇H₇KO₂S See *Thiozol*.
C₇H₇N Benzalimine, 3086⁹; chlorosulfonate, 2651¹.
C₇H₇NO Benzaldehyde, oxime, 3261¹.
 Benzamide, 1804⁹, 1983⁹, 3086⁹, 3261¹.
 Quinonimine, methyl-, 981⁹ & 9.
C₇H₇NO₂ (See also *Toluene, nitro*-.)
 Anthranilic acid, 2197¹, 3262⁷.
 Benzoic acid, amino-, 3315⁹.
 m-Cresol, nitroso-, P 78⁹.
 2-Furanacrolein, oxime, 1138⁹.
 Quinonimine, 2-methoxy-, 1857¹.
 Trigonelline, 1014¹.
C₇H₇NO₃ Anisole, *p*-nitro-, 2158⁴.
 Carbamic acid, Ph ester, 3258⁹.
 Cresol, nitro-, 1132⁹, 1413⁹.
 Glycine, *N*-fural-, *Ba* salt, 2639⁹.
 (1,2) Pyridineacetic acid, 2-keto-, *a* salt, 655⁹, 656¹.
 Salicylic acid, amino-, 1253⁹, P 2345⁹.
C₇H₇NO₃S Benzoic acid, *p*-sulfamyl-, 2317⁹, 3409⁹.
 Sulfone, methyl *m*-nitrophenyl-, 2647⁹.
C₇H₇NO₃S *o*-Toluenesulfohydic acid, 5-hydroxy-3-nitro-, *K* salt, 981¹.
C₇H₇NS Benzimidic acid, *o*-thio-, 2476¹, 3087¹.
C₇H₇NS₂ Carbamic acid, dithio-, 3085⁹.
C₇H₇N₂ Toluene, triazo-, 476⁹, 1253⁹, 2341¹ & 2, 2649¹.
C₇H₇ See *Toluene*.
C₇H₇AsNO₂ Benzoic acid, aminoarsono-, 479¹ & 4.
 p-Toluenearsonic acid, 2-nitro-, 479¹.
C₇H₇BrN *m*-Toluidine, 4-bromo-, 1259¹.
C₇H₇BrNO *m*-Anisidine, 4-bromo-, 2338¹.
C₇H₇BrNO₂ Cresorcinol, aminobromo-, -HBr, 2649¹.
C₇H₇BrNO₃ Benzoic acid, bromo-, NH₄OH salts, 2928⁹.
C₇H₇BrN₂S Semicarbazide, 4-(*p*-bromophenyl)-thio-, 988⁹.
C₇H₇ClN *o*-Toluidine, 4-chloro-, 1259¹.
C₇H₇ClNO *o*-Cresol, aminochloro-, 2340⁹.
C₇H₇ClNO₂ Benzoic acid, chloro-, NH₄OH salts, 2928⁹.
 2 Pyridol, chloroacetic acid addn. compd., 655⁹.
C₇H₇ClN₂S Semicarbazide, 4-(*m*-chlorophenyl)-thio-, 988⁹.
C₇H₇HgS *p*-Tolylmercuric mercaptan, 165⁴.
C₇H₇IN *o*-Toluidine, 4-iodo-, and salts, 2192¹ & 1.
C₇H₇N Benzaldehyde, phenylhydrazones, 2332¹.
C₇H₇N₂O Picotannamide, 6-methyl-, 2954¹.
 Urea, phenyl-, 266⁹.
C₇H₇N₂O₂ Benzylamine, nitro-, and salts, 3260⁹.
 Glycine, *N*-2-pyridyl-(?), 281¹, 1862⁹.
 -, *N*-(1-pyridylidene-?), 281¹.
 (1,2) Pyridineacetamide, 2-keto-, 656¹.
 (1,2) Pyridineacetic acid, 2-imino-, 1276⁹, 1862⁹.
 Succinimide, β -cyano- α,α -dimethyl-, 265⁹.
C₇H₇N₂O₃ Pyridine, 4-ethoxy-3-nitro-, and derivatives, 72⁹.
C₇H₇N₂O₄ Benzoic acid, nitro-, NH₄OH salts, 2925⁹.
C₇H₇N₂S Urea, phenylthio-, 1090¹.
C₇H₇N₂O₂ See *Theobromine*; *Theophylline*.
C₇H₇N₂O₃ Uric acid, dimethyl-, 210⁹, 1249¹.
C₇H₇O (See also *Benzyl alcohol*; *Cresol*.)
 Anisole, 480⁹, 1815⁹, 1705⁹.
C₇H₇O₂ Benzenedisulfonic acid, *Me* ester, 1865⁹.
C₇H₇O₃ (See also *Cresol*; *Salicylic*.)
 Cresorcinol, 2649¹.

- Malonic acid, bis(β -hydroxyethyl)¹, di-lactone, 2640¹.
 Phenol, *p*-methoxy-, 976¹, 3495⁴.
 1,4-Pyrone, 2,6-dimethyl-, 2822⁸.
p-Toluquinol, 48¹.
 C₇H₅O₂S Phenyl mercaptan, *m*-methylsulfonyl-, 2647¹.
 C₇H₅O₂ Benzyl alcohol, 4,4-dihydroxy-, 1567².
 Elsholtzic acid, Me ester, 1139⁴.
 α,γ -Pentadienaldehyde, δ -hydroxy-, acetate, 517¹.
 C₇H₅O₂S Benzaldehydesulfoxylic acid, 237¹.
 Toluenesulfonic acid, 980¹.
 C₇H₅O₄ Cyclopropanedicarboxylic anhydride, 3-methoxy-3-methyl-, 1410¹.
 $\Delta^1,2$ -Cyclopropanedicarboxylic acid, 3-methyl-, mono-Me ester, 1410¹.
 Fumaric acid, α -(β -hydroxyethyl)- β -methyl, lactone, 2809¹.
 C₇H₅O₂S K salt—see *Thiocol*.
 C₇H₅O₂ Malonic acid, bis(formylmethyl)¹, 1129¹.
 C₇H₅O₂S 1-Phenol 2,6-disulfonic acid, 4-methyl-, 2483¹.
 C₇H₅AsCl₄ Tris(β -chlorovinyl)methylarsonium iodide, and HgI₂ compd., 3250¹.
 C₇H₅AsN₂O₂ See *Trypsinamide*.
 C₇H₅AsO₂ *o*-Toluenearsonic acid, 478¹.
 C₇H₅BrN₂ Hydrazine, α -(*p*-bromophenyl)- α -methyl, 45¹.
 C₇H₅BrO₂ Glutaconic acid, α -bromo α,β or β,γ -dimethyl-, 470¹.
 C₇H₅ClN₂O Pyridine, 5-amino-2-chloro-4-ethoxy-, and *derivs.*, 72¹.
 C₇H₅ClN₂O₂ Uracil, 5-chloromethyl-3,6-dimethyl-, 1249¹.
 C₇H₅ClO Δ^1,α -Cyclopentaneacetyl chloride, 2032¹.
 Δ^1 -Cyclopentaneacetyl chloride, 2032¹.
 C₇H₅Hg₂NO₂ *m*-Toluidine, bis(hydroxymethyl)-, 49¹, 50¹.
 C₇H₅N See *Aniline*, *N*-methyl; *Benzylamine*; *Toluidine*.
 C₇H₅NO *o*-Anisidine, *ferriyanide*, 978¹.
 Anthranil, 3,4,5,6-tetrahydro-, and HgCl₂ compd., 1277¹.
 Benzisoxazole, 4,4,5,6-tetrahydro-, 1277¹.
m-Cresol, 2-amino-, 1413¹.
 Cyclohexanenitrile, 2-keto-, 1262¹.
 Hydroxylamine, β -tolyl-, 1252¹.
 Ketone, ethyl 2-pyrryl, 1421¹.
 4(1)-Lutidone, 472¹.
 Phenol, *p*-methylamino-, 2196¹.
 2(1)-Pyridone, 1,6-dimethyl-, 1973¹.
 2-Pyrrolealdehyde, 4,5-dimethyl-, 3270¹.
 C₇H₅NO₂ 3-Pyrrolicarboxylic acid, 2,5-dimethyl-, 2451¹.
 C₇H₅NO₂ Benzoic acid, NH₂OH salt, 2928¹.
 C₇H₅NO₂ Nipeptic acid, 3,5-dihydroxy-2-keto-1-methyl-, γ -lactone, 635¹.
 Salicylic acid, NH₂OH salt, 2928¹.
 C₇H₅N₂O Semicarbazide, phenyl-, 478¹, 3082¹.
 C₇H₅N₂O₂ Pyridine, 1-ethyl-1,2-dihydro-2-nitro-imino-, 1863¹.
 C₇H₅N₂S Semicarbazide, 1 (and 4) phenylthio-, 2053¹.
 C₇H₅AsN₂O₂ Toluenearsonic acid, amino-, 478¹, 479¹.
 C₇H₅BrO₂ Glutaric acid, α,β -dibromo- α,γ -dimethyl-, 471¹.
 C₇H₅ClNO₂ Malonic acid, chloronitro-, di-Ht ester, 2326¹.
 C₇H₅Cl₂O₂ Cyclohexanone, 1,2-dichloro-4-methyl, 2644¹.
 C₇H₅OCl₂ Adipyl chloride, β -methyl-, 1406¹.
 C₇H₅OCl₂O₂ Malonic acid, bis(β -chloroethyl)-, 2640¹.
 C₇H₅N₂ Δ^1 -Cyclohexanenitrile, 2-amino-, 1263¹.
 Hydrazine, tolyl-, 830¹, 1254¹.
 2,6-Lutidine, 3-amino-, 2955¹.
 Pyrazole, 1-allyl-3-methyl-, and *acrate*, 2953¹.
 Tolylenediamine, 501¹, 1411¹, 1597¹; -HCl, 480¹.
 C₇H₅N₂O Anthranil, 2-amino-3,4,5,6-tetrahydro-, 1262¹.
 Cyclohexanenitrile, 2-keto-, oxime, 1262¹.
 C₇H₅N₂O₂ Cresorcinol, 2,6-diamino-, di-HCl, 2649¹.
 Pyrrolicarboxylic acid, 1-amino-2,5-dimethyl-, 2451¹.
 Pyrazolecarboxylic acid, 3-methyl-, Et ester, 2953¹.
 2,5-Pyrrolopyrazine-1,4-dione, 2,3,6,7,8,8-hexahydro-, 2810¹.
 Uracil, 1,3,6-trimethyl-, 1249¹.
 C₇H₅N₂O₂S *p*-Toluenesulfonic acid, hydrazide, 2649¹.
 C₇H₅N₂O₂ Barbituric acid, 5-isopropyl-, 2641¹.
 -, 5-propyl-, 2641¹.
 Isonic acid, amino, NH₂OH salts, 2928¹.
 4-Pyridazinecarboxylic acid, 2,3,4,5-tetrahydro-3-keto-4,6-dimethyl-, 3480¹.
 Succinamic acid, α -cyano- β,β -dimethyl-, 268¹.
 C₇H₅N₂O₂ Semicarbazide, 4-anilino-, and -HCl, 182¹.
 C₇H₅O₂ Cyclohexecarboxylic acid, 3252¹.
 2-Furanacetal, α -ethyl-, 1563¹.
 C₇H₅O₂Te 1,2-Telluropyran-3,5(4,6)-dione, 2,6-dimethyl-, 2027¹.
 C₇H₅O₂ Adipic anhydride, β -methyl-, 1409¹.
 2-Furaldehyde, dimethylacetal, 1694¹.
 C₇H₅O₂ Citraconic acid, di-Me ester, 3263¹.
 Mesaconic acid, di-Me ester, 3263¹.
 C₇H₅O₂ Maleic acid, α -(β -hydroxyethyl)- β -methyl-, 2808¹.
 Pimelic acid, α -keto-, 1559¹.
 C₇H₅O₂S Xanthosuccinic acid, and Na salts, 1245¹.
 C₇H₅O₂ 1,3-Dioxolan-2-one, 4-(hydroxymethyl)-, bicarbonate, Et ester, 468¹.
 1,1,2-Propanetricarboxylic acid, 2-methyl-, 1408¹.
 C₇H₅BrO₂ Malonic acid, β -bromoethyl-, dimethyl ester, 2808¹.
 C₇H₅ClO Cyclohexanone, 2-chloro-4-methyl-, 1702¹, 2644¹.
 α -Pentenyl chloride, β -ethyl-, 1695¹.
 C₇H₅N Pyrrole, 1,4,5-trimethyl-, 2451¹.
 C₇H₅NO₂ Naprotic acid, 5-hydroxy-1-methyl-, lactone, HBr, 3084¹.
 Oxazole, 6-ethoxy-2,4-dimethyl-, 2051¹.
 C₇H₅NO₂ Acetoacetic acid, α -(iminomethyl)-, -HCl, 2332¹.
 C₇H₅NO₂ Fumaramic acid, (β -hydroxyethyl)-methyl-, 2809¹.
 Malonic acid, allyl(aminomethyl)-, 3084¹.
 C₇H₅N₂O₂ 4-Imidazolecarboxamide, tetrahydro-2,5-diketo-N,1,3-trimethyl-, 2811¹.
 C₇H₅N₂O₂ 4-Imidazolecarboxamide, tetrahydro-4-hydroxy-2,5-diketo-N,1,3-trimethyl-, 2811¹.
 C₇H₅N₂O₂ Malonic acid, acetonyl-, semicarbazone, 3480¹.
 C₇H₅O₂Sb Antimonyl isopropyl tartrate, 1256¹.
 C₇H₅O₂ Cyclohexane, methylene-, 1401¹.
 Heptide, 3470¹.

- γ -3-Pentadiene, 2,4-Gimethyl-, 2499¹.
 C₇H₁₃AsCl₄I Bis(β-chlorovinyl)ethylmethyl-
 arsonium iodide, 3250¹.
 C₇H₁₃BrNO Valeric acid, δ-bromo-γ-hydroxy-α-
 (methylaminomethyl)-, lactone, -HBr, 3084¹.
 C₇H₁₃BrN₂O Urea (α,β-dibromo-α-ethyl-
 butyryl)-, 1181¹.
 C₇H₁₃BrCl₂Mo₂NO, 1386¹.
 C₇H₁₃ClIN, Pyrazole, chloro-1-ethylmethyl-,
 methiodides, and perchlorates, 2952¹.
 C₇H₁₃Cl₂O₂Te, Telluracetone dichloride, methyl-
 enebis-, 1696¹.
 C₇H₁₃INO Valeric acid, γ-hydroxy-δ-iodo-α-
 (methylaminomethyl)-, lactone, -HI, 3084¹.
 C₇H₁₃N₂ Pyrazole, 1-ethyl-3,5-dimethyl-, 2953¹.
 C₇H₁₃N₂O Arecaidine aldehyde, oxime, 656¹.
 Cyclohexanenitrile, 2-amino-2-hydroxy-,
 1263¹.
 5-Pyrazolone, 3-methyl-4-propyl-, 2931¹.
 C₇H₁₃N₂O₂ 1,2-Cyclohexanedione, methyl-, di-
 oxime, 487¹.
 Piperidazine-N-carboxylic acid, endomethyl-
 ene-, Me ester, 2499¹.
 Urea, α-ethylcrotonyl-, 1129¹.
 C₇H₁₃N₂O₂Te 1,2-Telluropyran-3,5(4,6)-dione,
 2,6-dimethyl-, dioxime, 2027¹.
 C₇H₁₃N₂O₂S Glycine, N,N'-thiocarbonylbis-,
 mono-Et ester, 637¹.
 C₇H₁₃N₂O₂ Aspartic acid, N-alanyl-, 1248¹.
 C₇H₁₃N₂S Imidazole, 2-ethylmercapto-3,4-di-
 methyl-, and -HCl, 1709¹.
 C₇H₁₃N₂O₂Sb + H₂O Urea stibamine, 872¹.
 C₇H₁₃O Cyclohexane, 1,2-epoxymethyl-, 2644¹.
 Cyclohexanone, 4-methyl-, 2644¹.
 Cyclopentanone, dimethyl-, 239¹, 2933¹.
 Furan, 2-ethyl-2,5-dihydro-5-methyl-, 241¹.
 Δ²-2-Heptenone, 1247¹.
 C₇H₁₃O₂ Crotonic acid, α-ethyl-β-methyl-, 1697¹.
 Cyclohexanecarboxylic acid, 467¹, 1802¹,
 2040¹.
 Cyclohexanone, 4-methoxy-, 976¹.
 Isocrotonic acid, α-ethyl-β-methyl-, 1697¹.
 Lactone(?), m. 82°, from α-ethyl-, β-
 diethylglutaric acid, 1697¹.
 Pentenic acid, β-ethyl-, 1695¹, 2475¹.
 Δ¹-3-Pentenol, acetate, 2331¹.
 C₇H₁₃O₂ Enanthic acid, δ-keto-, 2476¹.
 Levulinic acid, α-ethyl-, 3480¹.
 C₇H₁₃O₂ Acetic acid, ethoxyformyl-, Et ester,
 1992¹.
 Glutaric acid, di-Me ester, SnCl₄ addn.
 compd., 50¹.
 —, β,β-dimethyl-, 1802¹.
 —, β-ethyl-, 1802¹.
 Lactic acid, Et ester, acetate, 444¹, 1407¹.
 Malonic acid, di-Et ester, 1415¹, 3185¹.
 Pimelic acid, 3252¹; Na salt, 1166¹.
 C₇H₁₃O₂ Acetic acid, trimethylenedithiobis,
 and salts, 1407¹.
 C₇H₁₃O₂ Acetic acid, P 77¹, 2931¹.
 Acetoacetic acid, α,γ-dimethoxy-, Me ester,
 1141¹.
 Malonic acid, ethoxy-, mono-Et ester, K
 salt, 1902¹.
 C₇H₁₃O₂ Quinic acid, 91¹, 126¹, 2041¹.
 Troxymethylene, diacetate, 1245¹.
 C₇H₁₃O₂ Glucuronic acid, α-3-methyl-, 1131¹.
 Glucuronide, methyl-, 41¹.
 C₇H₁₃BrN₂O Malonamide, α-bromo-N-isobutyl-,
 1699¹.
 Urea (bromo-α-ethylbutyryl)-, 1129¹, 1130¹.
 C₇H₁₃CdN₂O₂S, 1992¹.
 C₇H₁₃ClO Caproyl chloride, methyl-, 464¹.
 Ether, chloromethyl cyclohexyl-, 2930¹.
 C₇H₁₃ClO₂S, Glucoside, α-methyl-, 5-chloro-
 hydrin, acid sulfate, Na salt, 2480¹.
 C₇H₁₃CoN₂O₂S, 1995¹.
 C₇H₁₃CoN₂O₂S, 1995¹.
 C₇H₁₃N Capronitrile, methyl-, 464¹.
 C₇H₁₃NO Cyclopentanone, dimethyl-, oxime,
 239¹.
 Pentanamide, β-ethyl-, 1695¹.
 C₇H₁₃NO₂ Piperidineacetic acid, 1535¹.
 Stachydrine, 1140¹.
 Valeric acid, γ-hydroxy-α-(methylamino-
 methyl)-, lactone, -HBr, 3084¹.
 C₇H₁₃NO₂ Alanine, N-acetyl-, Et ester, 244¹,
 2051¹.
 C₇H₁₃NO₂S Glycine, N-(thionocarboxy)-, di-
 Et ester, 637¹.
 C₇H₁₃N₂ Histamine, dimethyl-, 2090¹.
 C₇H₁₃N₂O Δ²-Pyrazoline, 1-carbamyl-5-ethyl-4-
 methyl-, 2666¹.
 —, 1-carbamyl-3,5,6-trimethyl-, 2666¹.
 C₇H₁₃ 1-Butene, 2,3,3-trimethyl-, 1401¹.
 Cycloheptane, 2934¹.
 Cyclohexane, methyl-, 3476¹.
 3-Heptene, 3476¹.
 C₇H₁₃HgOS₂ Xanthic acid, butylmercuric deriv.,
 465¹.
 C₇H₁₃N₂ Δ²-Pyrazole 5-isopropyl-3-methyl-,
 2666¹.
 C₇H₁₃N₂OS Δ²Thiazoline, 5-ethoxy-4-methyl-2-
 methylamino-, and chloroplatinate, 1709¹.
 C₇H₁₃N₂O₂ Malonamide, N-isobutyl-, 1696¹.
 C₇H₁₃N₂O₂S Acetamide, α,α'-trimethylenedi-
 thiobis-, 1407¹.
 C₇H₁₃N₂O₂ Compd., m. 216°, from NH₃ and
 lactone of hydroxyethylmethylfumaric
 acid, 2809¹.
 C₇H₁₃N₂O₂ 1,3-Cyclopentanedicarboxylic acid,
 dihydrazide, 2499¹.
 Urea, α,α'-1,3-cyclopentylenebis-, 2189¹.
 C₇H₁₃O Butyrene, P 77¹.
 Caproaldehyde, β-methyl-, 463¹.
 Cyclohexanol, methyl-, 742¹, 1702¹, 3551¹.
 Enanthaldehyde, 1247¹, 1473¹, 2427¹.
 Δ¹-3-Heptenol, 2331¹.
 Δ²-2-Heptenone, 6-methyl-, 1401¹.
 C₇H₁₃O Amvl acetate, P 1867¹.
 Caproic acid, methyl-, 463¹, 464¹, 3251¹.
 Cyclohexanol, 4-methoxy-, 976¹.
 Enanthic acid, 1079¹, 3396¹.
 2-Heptanone, 4-hydroxy-, 1247¹.
 Isocaproic acid, α-methyl-, 3252¹.
 Valeric acid, α-ethyl-, 1802¹.
 C₇H₁₃O₂ Acetic acid, amyloxy-, Na salt, 1992¹.
 Butyric acid, ethoxymethyl ester, 2930¹.
 Methanol, sec-butyloxy-, acetate, 2930¹.
 Propionic acid, isopropoxymethyl ester,
 2930¹.
 C₇H₁₃O₂ Arabonic acid, Et ester, 817¹.
 Glucoside, methyl-, 41¹, 1250¹, 1804¹.
 d-Glucose, methyl-, 250¹.
 C₇H₁₃O₂ Glucoheptonic acid, 3256¹.
 C₇H₁₃BO₂ 1,1-Cycloheptanediolboric acid, 2178¹.
 C₇H₁₃Br Hexane, 1-bromo-3-methyl-, 463¹.
 C₇H₁₃BrClNO₂ δ-Hydroxyethyltrimethylam-
 monium bromide, chloroacetate, 1913¹.
 C₇H₁₃Cl Hexane, 1-chloro-3-methyl-, 463¹.
 C₇H₁₃HgI₂ Compd., m. 94.6°, from Et₂Si,
 C₆H₅I and HgI₂, 967¹.
 C₇H₁₃I Pentane, 2-ethyl-3-iodo-, 2638¹.
 C₇H₁₃N Cyclohexylamine, N-methyl-, HCl,
 2190¹.
 C₇H₁₃NO Caproamide, methyl-, 464¹.

- $C_7H_{11}NO_3$ Carbamic acid, butoxy-, Et ester, 2186².
 Oximidocarbonic acid, Bu Et ester, 970².
 $C_7H_{11}NS_2$ Carbamic acid, dipropylidithio-, salts, 973².
 $C_7H_{15}P_2S_2$ Phosphine, triethyl-, CS_2 addn. compd., 2473¹.
 C_7H_{16} (See also *Heptane*.)
 Pentane, dimethyl-, 337¹.
 $C_7H_{12}BrNO_2$ Carbethoxymethyltrimethylammonium bromide, 1913¹.
 $C_7H_{12}N_2$ Pilocarpine, α -amino-1-methyl-, 656².
 $C_7H_{12}N_2O_2$ Urea, *s*-bis(β -hydroxypropyl)-, 3253².
 $C_7H_{11}O$ 1-Hexanol, methyl-, 463¹, 464¹.
 Pentanol, dimethyl-, 337¹.
 " 3-ethyl-, 822¹.
 $C_7H_{10}O_2$ Heptanediol, 1563², 1564¹.
 2,3-Pentanediol, 2,4-dimethyl-, 352².
 $C_7H_{10}O_2$ 2,3,4-Heptanetriol, 2326².
 Valeraldehyde, γ -hydroxy-, dimethyl acetal, 2931².
 $C_7H_{11}O_4S_2$ See *Sulfonal*.
 $C_7H_{11}S_2$ Acetone, di-Et mercaptol, 3488¹.
 $C_7H_{17}N$ Hexylamine, methyl-, 4641¹.
 $C_7H_{17}NO_2$ Propionaldehyde, α -amino-, diethyl-acetal, 1709².
 $C_7H_{17}NO_2$ See *Choline acetate*.
 $C_7H_{17}BrFO_2$ [β - (β - Hydroxyethoxy)ethyl]trimethylammonium bromide, P 560².
 $C_7H_{17}INO_2$ [β - (β - Hydroxyethoxy)ethyl]trimethylammonium iodide, P 560².
 $C_7H_{17}IN_3$ Hexamethylguanidinium iodide, 1909².
 $C_7H_{17}NO_3$ [β - (β - Hydroxyethoxy)ethyl]trimethylammonium nitrate, P 560².
 $C_7H_{15}O_7P_5$ Inositol, methoxy-, pentaphosphoric acid, and salts, 1135².
 $C_7H_9Cl_2CoN_2O_2 + 1.5 H_2O$, 684¹.
 $C_7H_9CoI_2N_2O_2$, 684¹.
 $C_7H_9CoN_2O_2 + H_2O$, 684¹.
 $C_7H_9BrClCoF_2 + H_2O$, 674¹.
 $C_7H_9ClCoI_2N_2$, 674¹.
 $C_7H_9ClCoN_2O_2S_2$, 674¹.
 $C_7H_9ClCoN_2O_2$, 674¹.
 $C_7H_9Cl_2CoN_2 + H_2O$, 674¹.
 $C_7H_9Cl_2NNaO_2$ Isatin, 4-chloro-5,7-diiodo-, Na salt, 1422².
 $C_7H_9Cl_2INO_2$ Pseudoisatin, 4-chloro-5,7-diiodo-, 1422².
 $C_7H_9I_2NO_2$ Pseudoisatin, 5,6,7-triiodo-, 1422².
 $C_7H_9ClINO_2$ 3-Pseudoindolone, 2-chloro-5-iodo-, 506².
 $C_7H_9Cl_2NO_2$ Terephthalyl chloride, 2-nitro-, 1700².
 $C_7H_9Cl_2N_2$ Quinoxaline, 2,3,6-trichloro-, 1284².
 $C_7H_9I_2NO_2$ Pseudoisatin, 5,7-diiodo-, and $NaHSO_3$ compd., 1421², 1422².
 $C_7H_9NO_2$ Phthalic anhydride, 3-nitro-, 2939².
 $C_7H_9AgNO_2$ Isatin, Ag deriv., 2050².
 $C_7H_9ClNO_2$ 3-Pseudoindolone, 2-chloro-, 507¹.
 $C_7H_9Cl_2O$ Hydroquinol, bis(chloroformate), 3269¹.
 Resorcinol, bis(chloroformate), 3269¹.
 $C_7H_9HgNNaO_2$ Phthalimide, mono-Hg compd., Na salt, 1247¹.
 $C_7H_9Hg_2NNaO_2$ Phthalimide, di-Hg compd., Na salt, 1247¹.
 $C_7H_9INO_2$ Isatin, iodo-, 2048².
 Pseudoisatin, 5-iodo-, 506².
 $C_7H_9N_2$ Phthalonitrile, 261¹.
 $C_7H_9N_2O_2$ 2-Pyrrolenopyridinecarboxylic acid, 1-keto-, 72².
 $C_7H_9N_2O_2$ Pseudoisatin, 5-nitro-, 65².
 $C_7H_9N_2O_2$ Urindigo, 3069².
 $C_8H_5O_2$ See *Phthalic anhydride*.
 $C_8H_5O_2S$ Thionaphthenequinone, *S*-dioxide, 504¹.
 C_8H_5BrNO Benzoxazole, 3,5-dibromo-1-methyl-, 2340¹.
 $C_8H_5BrNO_2$ Phthalamic acid, 4,5-dibromo-, and NH_4 salt, 3262².
 $C_8H_5BrN_2$ 1,2,3-Triazole, 1-(2,4-dibromophenyl)-, 476².
 $C_8H_5BrN_2$ Indazole, 3,5,7-tribromo-2-methyl-, 512².
 $C_8H_5ClN_2O_2$ 2,3-Quinoxalinediol, 6-chloro-, 1284¹.
 $C_8H_5ClNO_2$ Anisoyl chloride, 3,5-dinitro-, 2824².
 $C_8H_5Cl_2NO$ Benzoxazole, 3,5-dichloro-1-methyl-, 2340¹.
 $C_8H_5Cl_2N_2$ 1,2,3-Triazole, 1-(dichlorophenyl)-, 476².
 $C_8H_5Cl_2O_2$ *p*-Toluic acid, α -trichloro-, 1259¹.
 $C_8H_5Br_2N_2O_2$ Benzoic acid, 2,4,6-trinitro-, methylmercuric ester, 2483².
 $C_8H_5INO_2$ Oxindole, 3-hydroxy-5,7-diiodo-, 1422².
 $C_8H_5NO_2$ (See also *Isatin*.)
 Isatol, 2050², 2951².
 Pseudoisatin, 507¹, 1422².
 $C_8H_5NO_2$ Phthalic acid, 3-nitro-, 2486¹, P 3492².
 Terephthalic acid, 2-nitro-, 1700².
 $C_8H_5N_2O_2$ Pseudoisatin, 5-nitro-, oxime, 65².
 1,5,2-Pyridopyrimidine-2,4(3)-dione, 3-nitro-, 70².
 1,7-Pyrrolopyridine-2-carboxylic acid, 2,3-dihydro-3-keto-1-nitroso-, 72².
 C_8H_6 Benzene, ethinyl-, 11², 2032², 2817², 3476².
 $C_8H_5AsCl_2$ Arsine, dichloro- β -chlorostyryl-, 2323².
 $C_8H_5BrN_2S_2$ 1,3,4-Thiodiazole-2-mercaptan, 5-(*p*-bromophenylimino)-4,5-dihydro-, 988².
 $C_8H_5BrN_2$ Indazole, 5,7-dibromo-2-methyl-, 512².
 $C_8H_5Br_2O_2$ Acetophenone, dibromohydroxy-, 2340¹.
 Benzaldehyde, 2,4-dibromo-5-methoxy-, 2040¹.
 C_8H_5ClN Tolunitrile, α -chloro-, 2815¹.
 $C_8H_5ClNO_2$ *p*-Tolyl chloride, 3-nitro-, 1700².
 $C_8H_5ClNO_2$ Acetanilide, 4-chloro-3,5-dinitro-, 2824².
 $C_8H_5ClN_2S_2$ 1,3,4-Thiodiazole-2-mercaptan, 5-(*m*-chlorophenylimino)-4,5-dihydro-, 988².
 $C_8H_5ClO_2$ Acetophenone, 2,4-dichloro-6-hydroxy-, 2340¹.
 $C_8H_5Cl_2O$ Xylenol, tetrachloro-, 267².
 Xylenone, tetrachloro-, 2339².
 $C_8H_5CuNa_2O_2$, 1521¹.
 C_8H_5NN Toluene, 5-iodo-2-isocyno-, 2192².
 $C_8H_5INNO_2$ Pseudoisatin, 5-iodo-, hydrazone, 506¹.
 C_8H_5NNA α -Tolunitrile, Na deriv., 51².
 $C_8H_5NO_2$ 1,5,2-Pyridopyrimidine-2,4(3)-dione, 70².
 α -Tolunitrile, *o*-nitro-, 3261¹.
 $C_8H_5NO_2$ Mandelonitrile, *o*-nitro-, 263², 2339².
 1,7-Pyrrolopyridine-2-carboxylic acid, 2,3-dihydro-3-keto-, and HCl , 72².
 $C_8H_5NO_2$ Styrene, *o*, β -diamino-, 2666¹.
 $C_8H_5NO_2$ Phthalamic acid, 3-nitro-, 3262².
 $C_8H_5NO_2$ Pyrocatechol, 3,5-dinitro-, monoacetate, 641¹.

C₂H₃N₃O₂ Pseudoisatin 5-nitro-, hydrazone, 65¹.

C₂H₃N₃O₂ 6,6'-Bisobarbituric acid, 3089¹.

C₂H₃N₃O₂ 1521¹.

C₂H₃O₂ 2-Thionaphthene, 2951¹.

C₂H₃O₂ (See also *Piperonal*.)

Phthalaldehyde acid, 52¹.

C₂H₃O₂ See *Phthalic acid*.

C₂H₃O₂ Thionaphthene, 1412¹.

C₂H₃AsCl₂ Araine, chloro-β-chlorovinylphenyl-, 2323¹.

C₂H₃AsO₂ Arsinous anhydride, o-carboxyphenyl-methyl-, 480¹.

C₂H₃AsO₂ Terephthalic acid, 2-arsono-, 479¹.

C₂H₃BrN₃O₂ Dipyrvic uride, bromo-, 637¹.

Hydantoin, 5 - [bromo-(2,3,4,5-tetrahydro-2,5-diketo-4-methyl-4-imidazoly)-methylene]-, 973¹.

C₂H₃BrO₂ Acetophenone, bromo-, 831¹, 1980¹.

C₂H₃BrO₂ α-Toluic acid, β-bromo-, 669¹.

C₂H₃BrO₂ Acetic acid, (β - bromophenyl-selenyl)-, 6260¹.

C₂H₃BrO₂ Benzoic acid, bromo-3-methoxy-, 2040¹.

C₂H₃BrO₂ Anisic acid, 5-bromo-2-mercapto-, 2338¹.

C₂H₃BrO₂ Acetic acid, (β-bromophenyl-selenyloxy)-, 3260¹.

C₂H₃BrNO₂ Acetophenone, 2,4-dibromo-6-hydroxy-, oxime, 2340¹.

C₂H₃BrO₂ Anisole, 2,3,5-tribromo-4-methyl-, 1700¹.

C₂H₃BrO₂ Acetic acid, (β-bromophenyl-selenyl)-, dibromide, 3260¹.

C₂H₃BrO₂ Acetic acid, (β-bromophenyl-selenyl), tetrabromide, 3260¹.

C₂H₃Cl Styrene, α-chloro-, 3263¹.

C₂H₃ClO Acetophenone, o-chloro-, 1406¹.

α-Tolualdehyde, β-chloro-, 3261¹.

C₂H₃ClO₂ Benzoic acid, o-chloro-, methyl ester, 1081¹.

Toluic acid, chloro-, 42¹, 669¹, 2815¹.

C₂H₃ClO₂ Vanillin, 5-chloro-, 2494¹.

C₂H₃Cl₂O Acetamide, dichloro-, 1132¹.

C₂H₃Cl₂NO₂ Acetophenone, 2,4-dichloro-6-hydroxy-, oxime, 2340¹.

C₂H₃Cl₂O Benzyl alcohol, α-(trichloromethyl)-, 348¹, 982¹.

3,4-Xylenol, 2,5,6-trichloro-, 867¹.

C₂H₃HgN₃O₂ Benzene, 2-ethylmercuri-1,3,5-trinitro-, 665¹.

C₂H₃IN₃ Indazole, 3-iodo-2-methyl-, 512¹.

Isindazole, 3-iodo-1-methyl-, 512¹.

C₂H₃IN₃O₂ Acetamide, p-iodo-α-isonitroso-, 506¹.

C₂H₃IO Acetophenone, o-iodo-, 1406¹.

C₂H₃IO Vanillin, β-iodo-, 2494¹.

C₂H₃I (See also *Indole*.)

Pseudoindole, 2209¹.

Tolunitrile, 756¹, 2815¹, 2817¹.

C₂H₃NO Benzyl alcohol, α-isocyano-, 1134¹, 2485¹.

Indoxyl, 2051¹.

Mandelonitrile, 1134¹.

Oxindole, 1700¹.

C₂H₃NO₂ 2-Indolol, 3-mercapto-(?), 2337¹.

Oxindole, 3-mercapto-(?), 2337¹.

C₂H₃NO₂ 2,3,1-Benzoxazin-1-ol, 2037¹.

Pseudoindol-1-ol, 2-oxide, 2037¹.

C₂H₃NO₂ (21)-Benzoxanone, 5-hydroxy-, oxime, 1421¹.

Compd., m. 95¹, 3-methyl-2-furoyl-acetic acid and NH₄OH.HCl, 1139¹.

Glyoxylohydroxamic acid, phenyl-, 2638¹; and salts, 2854¹.

o-Quinone, 4-acetamido-, 1850¹.

Phthalamic acid, 3262¹.

C₂H₃NO₂ p-Toluic acid, 5-nitro-, 1700¹.

C₂H₃NO₂ Anisaldehyde, 2-hydroxy-5-nitro-, 1701¹.

C₂H₃NO₂ Anisic acid, 2-hydroxy-5-nitro-, 1701¹.

C₂H₃NS Isothiocyanic acid, tolyl ester, 2646¹.

C₂H₃N₃ 1,2,4-Triazole, 1-phenyl-, 3340¹.

C₂H₃N₃O₂ 2,4,5-Pyridopyrimidin-1-ol, 3-methyl-, 72¹.

C₂H₃N₃O₂ Anthranilonitrile, N-methyl-5-nitro-, 819¹.

Indazole, 2-methyl-4-nitro-, 3092¹.

Isindazole, 1-methyl-4-nitro-, 3092¹.

C₂H₃N₃O₂ Glyoxylanilide, nitro-, oxime, 66¹.

C₂H₃N₃O₂ Isatic acid, 5-nitro-, oxime, 65¹.

C₂H₃N₃O₂ Anisamide, 3,5-dinitro-, 2824¹.

Hydantoin, 1,3-diacyl-5-nitromethylene-, 2188¹.

C₂H₃N₃O₂ Phenetole, 2,4,6-trinitro-, 1700¹.

3,5-Xylenol, 2,4,6-trinitro-, P 1033¹.

C₂H₃N₃O₂ Aniline, N-ethyl-2,4,6-trinitro-N-nitroso-, P 300¹.

C₂H₃N₃O₂ Aniline, N-ethyl- or, N-tetranitro-, P 733¹.

C₂H₃ See *Styrene*.

C₂H₃AgNO₂ Formaldehydesulfoxylic acid, 4-amino-2-mercaptobenzoic acid deriv., Ag deriv., P 3491¹.

C₂H₃AsClO₂ Benzoic acid, o-(chloromethyl-arsyl)-, 490¹.

C₂H₃AsNO₂ p-Toluic acid, 3-arsono-5-nitro-, 479¹.

C₂H₃AsClO₂ Oxide, bis[bis(β-chlorovinyl)-arsyl], 3259¹.

C₂H₃AsCl₂S Sulfide, bis[bis(β-chlorovinyl)-arsyl], 3259¹.

C₂H₃BrNO₂ Aniline, β-bromo-N-methoxymethylene-, 978¹.

C₂H₃BrNO₂ Benzaldehyde, bromomethoxy-, oxime, 2040¹.

C₂H₃BrNO₂ Anisic acid, 2-amino-5-bromo-, and salts, 2338¹.

2,5-Xylenol, 4-bromo-6-nitro-, 2340¹.

C₂H₃BrNS Acetamide, m-hydroxy-, 471¹.

C₂H₃BrNO₂ Aniline, 2-bromo-N,N-dimethyl-4,6-dinitro-, 981¹.

C₂H₃BrN₃O₂ Acetic acid, 2,4-dibromophenyl-hydrazide, and -HBr, 2936¹.

C₂H₃ClHgNO₂ Aniline, 2-acetoxymercuri-4-chloro-, 501¹.

C₂H₃CIN Acetimidyl chloride, N-phenyl-, 2476¹.

C₂H₃CINO Acetamide, N-chloro-, 1132¹.

Aniline, p-chloro-N-methoxymethylene-, 979¹.

C₂H₃CINO₂ o-Xylenol, 3-chloro-5-nitro-, 267¹.

C₂H₃CINO₂S Sulfide, β-chloroethyl o-nitrophenyl-, 1852¹.

C₂H₃CINO₂ 3,5-Xylenol, 4-chloro-2-nitro-, 2339¹.

C₂H₃CINO₂ 2,5-Xylenesulfonyl chloride, nitro-, 2195¹.

C₂H₃CINS Acetamide, p-chlorothio-, 471¹.

C₂H₃Cl₂O₂ Caffeine, 7,8-dichloro-, 2345¹.

C₂H₃Cl₂O₂ Xylenol, dichloro-, 667¹.

C₂H₃Cl₂O₂ 2,5-Xylene-1,3(a:4,1:4)disulfonyl chloride, 2195¹.

C₂H₃Cl₂O₂ Cyclohexanone, 2,3,4,6-tetrachloro-5,β-dimethyl-, 208¹.

C₂H₃INO Acetophenone, α-iodo-, oxime, 140¹.

C₂H₃INS Acetamide, p-iodothio-, 471¹.

- $C_6H_5NH_2O$ Acetophenone, oxime, Na salt, 2475⁹.
 C_6H_5N Naphthyridine, 1,2-dihydro-, and -HCl, 1873⁸.
 $C_6H_5N_2O$ 1,4-Imidazopyridin - 2(3) - one, 8-methyl-, and chloroplatinate, 1275⁹, 1276².
 $C_6H_5N_2O_2$ Glyoxime, phenyl-, 262⁹.
 $C_6H_5N_2O_3$ Glyoxylohydroxamic acid, oxime, and Na derivs., 2638^{2,4,5}.
 $C_6H_5N_2O_4$ 4-acetamido-, oxime, 1856⁹.
 $C_6H_5N_2O_4$ Acetanilide, 4,5-dihydroxy-2-nitroso-, 2330⁴.
 Nicotinic acid, 4-[(carboxymethyl) amino]-, 72⁹.
 Terephthalic acid, 2,5-diamino-, and salts, 1274¹.
 $C_6H_5N_2O_5$ Anisaldehyde, 2-hydroxy-5-nitro-, oxime, 1701¹.
 Phenetole, 2,4-dinitro-, 1700⁹.
 $C_6H_5N_2O_5S$ *p*-Sulfobenzenediazonium acetate, 2200².
 $C_6H_5N_2O_6$ Benzaldehyde, 2,6-dinitro-, methylhydrazone, 3062⁴.
 —, 3-hydroxy-6-nitro-, semicarbazone, 2332¹.
 Hydantoin, 5 - (2,3,4,5 - tetrahydro - 2,5-diketo - 4 - -methyl - 4 - imidazolyl)-methylene-, 976².
 $C_6H_5N_2O_7$ Isocyanilic acid, diacetyl-, 2607⁹.
 C_6H_5O Acetophenone, 1899⁹, 2440⁹.
 Styrene oxide, 2650⁹.
 Toluyldehyde, 821⁷, 2042⁷, 3261³.
 $C_6H_5O_2$ (See also *Anisaldehyde*; *Toluic acid*)
 5-Benzofuranol, 1,2-dihydro-, 1421⁴.
 $\Delta^{1,3,4}$ -Cycloheptatrienecarboxylic acid, 3252¹.
 Propionaldehyde, α -2-fural-, 1139⁹.
 $C_6H_5O_3S$ Acetic acid (phenylselenyl)-, 3260².
 $C_6H_5O_4$ (See also *Vanillin*.)
 Acetic acid, phenoxy-, 1599⁹.
 Anisic acid, salts, 2816¹.
 Benzaldehyde, 5 - hydroxy - 2 - (hydroxy-methyl)-, 3125².
 3,5-Benzofurandiyl, 1,2-dihydro-, 484¹.
 Guaiscol, formate, 47⁴.
 Mandelic acid, 2940⁹.
 Salicylaldehyde, 5-(hydroxymethyl)-, 3125².
 Salicylic acid, Me ester, 756², 2648⁹, 3124⁴, 3185⁹, 3487⁹.
 Toluic acid, α -hydroxy-, 2815², 3411⁹.
 $C_6H_5O_5$ Dehydroacetic acid, 286⁹, 472¹.
 Fisetol, 260¹.
 Guaiacolcarboxylic acid, basic *Bi salt*, P 705⁴.
 p -Oraellinic acid, 1260⁹.
 Vanillic acid, 1580⁹.
 $C_6H_5AsH_2O_3$ Arsanilic acid, *N*-isonitrosoacetyl-, 2646⁹.
 $C_6H_5AsH_2O_4$ *m*-Arsanilic acid, 4 hydroxy-*N*-isonitrosoacetyl-, 2646⁹.
 $C_6H_5AsO_3$ Benzoic acid, α -(methylarsino)-, 450¹.
 $C_6H_5AsO_4$ *p*-Toluic acid, 3-arsono-, 479¹.
 C_6H_5Br Xylene, α -bromo-, 474¹.
 $C_6H_5BrN_2O$ Acetic acid, β -bromophenylhydrazide, and -HBr, 2930⁴.
 $C_6H_5BrN_2O_3$ Hydantoinic acid, α -(bromo-(2,3,4,5-tetrahydro-2,5-diketo-4-methyl-4-imidazolyl)methylene)-, 973⁹.
 C_6H_5BrO Anisole, 3-bromo-4-methyl-, 2338⁷.
 $C_6H_5BrO_2$ Benzyl alcohol, 2-bromo-4-hydroxy-6-methyl-, 2700⁴.
 C_6H_5Cl Xylene, α -chloro-, 2480¹.
 $C_6H_5ClN_2O$ Aniline, *N*-(β -chloroethyl)-*p*-nitroso-, and -HCl, 263².
 C_6H_5ClO Benzyl alcohol, 3-chloro- α -methyl-, 1666¹.
 Phenol, 4-chloro-2-ethyl-, 371¹.
 3,4-Xylenol, 5-chloro-, 267⁹.
 $C_6H_5ClO_2$ α -Xylorcinol, 2-chloro-, 267⁹.
 C_6H_5ClS Sulfide, β -chloroethyl phenyl-, 1855⁹.
 $C_6H_5Cl_2N$ 2,5-Xylidine, dichloro-, 255¹.
 $C_6H_5Cl_2NO$ Tyramine, dichloro-, 277⁹.
 $C_6H_5Cl_3O$ Δ^2 -Cyclohexenone, 2,3,4-trichloro-5,6-dimethyl-, 267⁹.
 C_6H_5F Benzene, ethylfluoro-, 2950⁴.
 Xylene, fluoro-, 2781².
 $C_6H_5IN_2O$ Urea, α -(4-iodo-*o*-tolyl)-, and -HCl, 2192².
 C_6H_5N Phenethylidenemine, 3086⁹.
 C_6H_5NO (See also *Acetanilide*.)
 Acetophenone, oxime, 982².
 —, amino-, 2621², -HI-, 263⁴.
 Benzaldehyde, oxime, Me ether, 2927².
 1-Propanone, 1-(2-pyridyl)-, and -HNO₃, 1281¹.
 C_6H_5NOS Benzamide, *p* - methylmercapto-, 2031⁴.
 $C_6H_5NO_2$ Anthranilic acid, *N*-methyl-, 2618².
 Benzoic acid, *m*(and *p*)-amino-, Me ester, 2650⁹.
 α -Cresol, carbamate, 3269⁹.
 Cresotamide, 51⁹, 521⁹.
 Picolinic acid, 6-methyl-, 2954⁴.
 Propionaldehyde, α -2-fural-, oxime, 1139¹.
 Toluic acid, amino-, 670¹, 3315⁹; and sulfate, 1412².
 $C_6H_5NO_3$ Carbamic acid, hydroxy-, tolyl ester, 3258⁹.
 Glycine, *p*-hydroxyphenyl-, 2305⁹.
 2,6-Lutidine-3-carboxylic acid, 1,4-dihydro-4 keto-, 472².
 Phenetole, *m*-nitro-, 820⁹.
 1(2)-Pyridineacetic acid, 2-keto-, Me ester, 656¹.
 Pyrroleacetic acid, α -keto-, Et ester, 2493⁹.
 3 Pyrrolecarboxylic acid, 2-formyl-4,5-dimethyl-, 3270⁹.
 2,5-Xylenol, 6 nitro-, 2310⁹.
 $C_6H_5NO_3S$ Benzenesulfonic acid, *p*-acetamido-, 175⁹.
 $C_6H_5NO_4$ 3,4-Pyrroledicarboxylic acid, 2,5-dimethyl-, 2451¹.
 $C_6H_5NO_5$ 2,5-Xylenesulfonic acid, 4-nitro-, 2195².
 C_6H_5NS Acetimidic acid, *N*-phenylthio-, 2476⁴.
 $C_6H_5NS_2$ Carbanilic acid, methylidithio-, salts, 973⁹.
 $C_6H_5N_3$ Xylene, triazo-, 2341¹.
 $C_6H_5N_4O$ Biuret, α -1-phenyl- β 972⁹.
 2 Furanacrolein, semicarbazone, 1138⁹.
 C_6H_6 (See also *Xylene*.)
 Benzene, ethyl-, 117, 1222⁹, 1515⁹.
 $C_6H_6AsNO_3$ (See also *Stoarsol*.)
 m Arsanilic acid, *N*-acetyl-4-hydroxy-, 3323^{4,7}.
 Carbanilic acid, arsonio-, Me ester, 979⁹.
 β Toluic acid, 3 amino-5-arsono-, 470¹.
 C_6H_5BrN Aniline, *p*-bromo-*N*,*N*-dimethyl-, ferri- and ferrocyanide, 978^{1,2}.
 C_6H_5BrNO *m*-Anisidine, 4-bromo-6-methyl-, 2338⁸.
 Ethanol, 2 (*p*-bromoanilino)-, 2481¹.
 2,5-Xylenol, 6 amino-4-bromo-, 2340⁹.
 $C_6H_5BrNO_2$ *s* - Maleimide, 3 - (β - bromo- α -methoxyethyl)-4-methyl-, 2664⁴.
 C_6H_5ClN Aniline, *N* - (β - chloroethyl)-, -HCl, 263².
 Xylidine, chloro-, 255¹, 267⁹, 2341¹.
 C_6H_5ClNO Phenethylamine, chloro-*p*-hydroxy-, and -HCl, 2817².
 3,5-Xylenol, 2-amino-4-chloro-, 2339⁹.

- C₈H₁₀Cl₂O Δ-Cyclohexenone, 2,3-dichloro-5,5-dimethyl-, 267¹.
- C₈H₁₀N₂O Acetamide, α-anilino-, 3083².
Acetanilide, p-amino-, 278².
Aniline, N,N-dimethyl-p-nitroso-, ferri- and ferrocyanide, 978^{1,2}.
Hydrazine, α-acetyl-β-phenyl-, 1254¹.
Nicotinamide, N-ethyl-, 3114¹.
Picoline, acetamido-, 518¹, 2954¹.
- C₈H₁₁N₂O Benzyl alcohol, α-methylnitroso-amino-, 1134¹.
Benzylamine, N-methyl-m (and p)-nitro-, and salts, 3261¹.
Isonicotinic acid, 3-amino-2,6-dimethyl-, and salts, 2955².
Quinone, 2,5-bis(methylamino)-, 259¹.
Urea, p-anisyl-, 637¹.
—, α-(α-hydroxybenzyl)-, and HgCl₂ salt, 1134¹.
- C₈H₁₁N₂O₂ 3,4 - Furandicarboxamide, 2,5 - dimethyl-, 502¹.
- C₈H₁₁N₂O₂ Compd. from 2,4-dimethyl-3-pyrrolepropionic acid and HNO₃, m. 215°, 2336².
2,5-Piperazinedione, 1,4-diacetyl-, 995^{1,4}.
2,5-Pyrazinediol, 3,6-dihydro-, dicetate, 995⁴.
- C₈H₁₁N₂O₂S Toluic acid, disulfamyl-, 2195^{1,4}.
- C₈H₁₀N₄ Triazetindazole, 5,6,7,8 - tetrahydro-5-methyl-, 1263¹.
- C₈H₁₁N₄O₂ (See also *Caffeine*.)
Cryogenin, 1348².
- C₈H₁₁N₄O₂ Uric acid, 1,3,9 trimethyl-, 2811².
- C₈H₁₁N₄O₂ Hydantoin, 5 (2,6), 4,5-tetrahydro-2,5 - diketone - 4 - methyl - 4 - imidazolyl)-methyl-, 973².
m - Phenylenediamine, N¹, N² dimethyl-2,4-dinitro-, 978¹.
- C₈H₁₁N₄O₂ Glycine, N-(aminocyanamino-methylene)- (α), dioxalate, 2052².
5 - Oxazolidone, 2-amino-2-cyanamino- (?), dioxalate, 2052².
- C₈H₁₁N₄O Benzyl alcohol, α-methyl-, 1890².
Phenethyl alcohol, 1244¹, 1473², 2104¹, 2666¹.
Phenylele, 489¹, 1361¹, 2648¹.
Xylenol, 2648¹.
- C₈H₁₀O₂ Benzene, p-dimethoxy-, 2042¹.
2-Furancarbinol, propionate, 987².
Tyrosol, 3290¹.
Xyloquinol, 48¹, 1251¹.
- C₈H₁₀O₂S Sulfone, methyl m methylmercapto-phenyl-, 2647¹.
- C₈H₁₀O₂ Benzyl alcohol, 2-hydroxy-5 methoxy-, 977¹.
Elsoltzic acid, Et ester, 1139¹.
Phenol, 3,5-dimethoxy-, 2041¹.
- C₈H₁₀O₂S p-Toluenesulfonic acid, Me ester, 2647¹.
Xylenesulfonic acid, and Ca salt, 977^{1,2}.
- C₈H₁₀O₂ Δ^{1,2}-Cyclopropenedicarboxylic acid, 3-methyl-, mono-Et ester, 1410².
Maleic anhydride, α-(β-methoxyethyl)-β-methyl-, 2809¹.
- C₈H₁₀O₂ Hematin acid, 2823¹.
- C₈H₁₀O₂ 2,5-Xylene-1,3-disulfonic acid, 2105¹.
- C₈H₁₀O₂ Phenyl mercaptan, o-ethyl-, 1412².
Sulfide, ethyl phenyl-, 1850¹.
—, methyl p-tolyl-, 1850¹.
- C₈H₁₀O₂ Δ-Cyclohexenone, 3-chloro-5,5-di-methyl-, 2607¹.
- C₈H₁₀Cl₂O Acetic acid, trichloro-, di-Me succinate addn. compd., 3252¹.
- C₈H₁₁N₂ Aniline, N,N-dimethyl-, 198¹, 1252¹, 1520¹, 1979¹, 2036¹, 2814¹; ferri- and ferrocyanide, 978^{1,2}.
Aniline, N-ethyl-, 706¹, 1252¹, 1520¹, 1861¹, 2648¹, 3058¹, 2814¹.
Benzylamine, methyl-, 13¹, 1520¹, 2038¹, 2708¹; -HCl, 3260¹.
β-Collidine, 1573¹.
Phenethylamine, 825¹, 848¹, 1137¹, 2705¹.
Xylidine, 255¹, 1520¹, 2192¹, 3485¹; ferri- cyanide, 978¹.
- C₈H₁₁NO (See also *Tyramine*.)
p-Anisidine, N-methyl-, 2048¹.
Anthranil, 3,4,5,6 - tetrahydro - 6 - methyl-, 1277¹.
Benzisoxazole, 3,4,5,6 - tetrahydro - 6 - methyl-, and HgCl₂ compd., 1277¹.
Benzyl alcohol, α-methylamino-, 1134¹.
Cyclohexanenitrile, 2-ketomethyl-, 1262¹.
Hydroxylamine, β-xylyl-, 1252¹.
Ketone, methyl 4,5-dimethyl-2-pyrryl, 3270¹.
p-Phenetidine, 1411¹.
Phenol, dimethylamino-, 2196¹.
Picoline, ethoxy-, and chloroplatinate, 2342¹.
1-Propanol, 1-(2 pyridyl)-, 1281¹.
2,5 Xylenol, 6 amino-, 2340¹.
- C₈H₁₁NO₂ Ethanesulfonamide, 257¹.
- C₈H₁₁NO₂ Pyrrolecarboxylic acid, Prester, 2492¹.
—, trimethyl-, 2451¹.
- C₈H₁₁NO₂ Toluic acid, NH₂OH salts, 2928¹.
- C₈H₁₁NO₂ Mandelic acid, NH₂OH salt, 2928¹.
- C₈H₁₁NS Benzene-sulfenamide, N,N-dimethyl-, 1855¹.
- C₈H₁₁N₂NaO Barbitol, Na deriv., 2243¹.
- C₈H₁₁N₂OPS Diazophospholig, phenoxy-P-thio-dihydro-, 2426¹.
- C₈H₁₁N₂O Semicarbazide, 4-p-tolyl-, 478¹.
- C₈H₁₁N₂O 3-Pyrrolecarboxylic acid, 1-carbamido-, 2,4-dimethyl ester, 2451¹.
- C₈H₁₂ Dibutadiene, 648¹.
- C₈H₁₂AgCrN₂O₄ + H₂O, 67¹.
- C₈H₁₂Br₂O Succinic acid, α,β dibromo-, di Et ester, 246¹.
- C₈H₁₂Cl₂N₂O Piperazine, 1,4 bis(chloroacetyl)-, 2830¹.
- C₈H₁₂Cl₂O₂Te 1,2 - Telluropyran - 3,5(4,6) - dione, 2,4,6 - trimethyl-, 1,1-dichloride, 2027¹.
- C₈H₁₂Cl₂O₂Th + H₂O, 1671¹.
- C₈H₁₂CrIK₂N₂O₄ + 2H₂O, 67¹.
- C₈H₁₂CrK₂N₂O₄ + 2H₂O, 67¹.
- C₈H₁₂N₂Δ¹ - Cyclohexanenitrile, 2 - amino - 3 - methyl-, 1263¹.
p-Phenylenediamine, dimethyl-, 2356¹.
Pyrrole, 3 - (iminomethyl)-, 2,4,5 - trimethyl-, -HCl, 2330¹.
- C₈H₁₂N₂O Anthranil, 2 - amino - 3,4,5,6 - tetrahydro 6 - methyl-, and -HCl, 1261¹.
Cyclohexanenitrile, 2-ketomethyl-, oxime, 1262^{1,2}.
Hydrazine, α-p-anhyd-β-methyl-, 2048¹.
3,5-Xylenol, 2,6-diamino-, 2340¹.
- C₈H₁₂N₂O₂ 1-Pyrrolecarboxylic acid, 3,5-dimethyl-, Et ester, 2953¹.
3-Pyrrolecarboxylic acid, 1-amino-2,4,5 trimethyl-, 2451¹.
- C₈H₁₂N₂O₂ (See also *Barbitol*.)
Barbituric acid, 5-butyl-, 2641¹.
—, 5-isobutyl-, 2641¹.
4-Pyridazincarboxylic acid, 4-ethyl-2,3,4,5-tetrahydro-3-keto-6-methyl-, 3480¹.
—, 3,2,4,5-tetrahydro-3-keto-6-methyl-, Et ester, 3480¹.
- C₈H₁₂N₂O₂ Aniline-2-thiosulfonic acid, 1-amino-4-N-dimethyl-, 513¹.

- C₆H₁₂N₂O₂** Xylene-1,3-disulfonamide, 2195².
C₆H₁₂N₂O Cyclohexanenitrile, 2-keto-, semicarbazono, 1262².
C₆H₁₂O 2-Propanone, 1-Δ¹-cyclopentenyl-, 2032².
 Tanacetophorone, 3087².
C₆H₁₀O₂ Bicyclo[0.1.4]heptane - 7 - carboxylic acid, 3252¹.
 1,3-Cyclobutanedione, 2,2,4,4-tetramethyl-, 2188².
 Δ¹-α-Cyclohexanecarboxylic acid, 2475², 3252¹.
 Cyclohexanecarboxylic acid, 2 - keto - 3 - methyl-, 1277².
 1,3-Cyclohexanedione, 5,5-dimethyl-, 1263².
 Cyclohexanecarboxylic acid, 3252¹.
 Δ²-Cyclohexenol, acetate, 1857⁷.
C₆H₁₀O₂Te 1,2 - Telluropyran - 3,5(4,6) - dione, 2,4,6-trimethyl-, 2027².
C₆H₁₀O₂ Cyclohexanone, 2-(hydroxymethylene)-4-methoxy-, 977¹.
C₆H₁₀O₄ 1,2-Cyclohexanedicarboxylic acid, Et ester, 474².
 1,3-Cyclohexanedicarboxylic acid, 3483².
 Pumaric acid, di-Et ester, *SnCl₄ and SbCl₅ addn. compds.*, 509, 511.
 Glutaric acid, α-hydroxy-α-(and γ)-methyl-, mono Et ester, γ-lactone, 1408².
 α-hydroxy-β,γ-trimethyl-, γ-lactone, 3230².
 Maleic acid, di-Et ester. *SnCl₄ and SnBr₄ and SbCl₅ addn. compds.*, 509, 511.
C₆H₁₀O₂ Malonic acid, acetyl-ethyl-, 3480².
 Suberic acid, α-keto-, 1550².
C₆H₁₀O₂N₂ Phthalic acid, NH₂OH salt, 2928².
C₆H₁₀O₂Pb See *Lead acetates*.
C₆H₁₀BrN₂O₂ Cyclohexanecarboxylic acid, bromo-, uride, P 3351².
C₆H₁₀BrN₂O₂ Valeric acid, 1-bromo-γ-hydroxy-δ-methylamino-α-methylcarbamyl-, γ-lactone, -HBr, 635².
C₆H₁₀BrO₂ Glutaric acid, α-bromo-γ-methyl-, di-Me ester, 1408².
C₆H₁₀ClO₂ Glutaric acid, α-chloro-γ-methyl-, di-Me ester, 1408².
C₆H₁₀Cl₃O₂ s-Trioxane, 2,4-dimethyl-6-(α,α,β-trichloropropyl)-, 2421.
C₆H₁₀IO₂ Glutaric acid, α-iodo-γ-methyl-, di-Me ester, 1408².
C₆H₁₀NO Pyridine, 3-acetyl-1,2,5,6-tetrahydro-1-methyl-, and salts, 659².
C₆H₁₀NO₂ (See also *Arecoline*).
 Addn. compd., hydroquinol and dimethylamine, 2589.
 Addn. compd., hydroquinol and ethylamine, 2589.
 Cyclohexanecarboxylic acid, 2-keto-3-methyl-, oxime, 1277².
 Δ¹-Cyclohexanecarboxylic acid, 2-hydroxy-3-methyl-, oxime, 1277².
 Eranthic acid, cyano-, 1262².
C₆H₁₀NO₂ Cyclopropanecarboxylic acid, 1-acetyl-, ethyl ester, oxime, 2809¹.
C₆H₁₀NO₂ Alanine, N-pyruvyl-, Et ester, 3255².
 Malonic acid, allyl(methylaminomethyl)-, 3084².
 (β-hydroxypropyl)(methylaminomethyl)-, lactone, -HBr, 3084².
C₆H₁₀N₂ Indazole, 3-amino-4,5,6,7-tetrahydro-7-methyl-, and -HCl, 1263¹.
C₆H₁₀N₂O₂ Pimelic acid, α-keto-, semicarbazono, 1559².
C₆H₁₀O₂Sb Antimonyl butyl tartrate, 1256².
C₆H₁₁ Bicyclo[0.1.3]hexane, 3,3 - dimethyl-, 3087².
 Octene, 1850⁷, 3270⁸.
C₆H₁₁BrNO₂ Nipecotic acid, 5-hydroxy-1-methyl-, lactone, methobromide, 3084².
 Valeric acid, δ-bromo-α-(dimethylamino-methyl)-γ-hydroxy-, acetone, -HBr, 3084².
C₆H₁₁Br₂ Cyclohexane, 3,5-dibromo-1,1-dimethyl-, 3087².
C₆H₁₁Cl₃O₂ s-Trioxane, 2-(α,β-dichloropropyl)-4,6-bimethyl-, 241².
C₆H₁₁Cl₃O₂Tl₂, 1671⁷.
C₆H₁₁N₂ Pyrazole, 3,5 - dimethyl - 1 - propyl-, 2953⁴.
C₆H₁₁N₂O Cyclohexanenitrile, 2-amino-2-hydroxy-3-methyl-, 1263¹.
C₆H₁₁N₂O₂ Cyclohexanecarboxylic acid, ureide, P 3351².
 2,5-Piperazinedione, 3-isobutyl-, 3024.
C₆H₁₁N₂O₂Te 1,2-Telluropyran-3,5(4,6)-dione, 2,4,6-trimethyl-, dioxime, 2027².
C₆H₁₁N₂O₂ Valeric acid, γ-hydroxy-δ-methylamino-α-methylcarbamyl-, γ-lactone, 635².
C₆H₁₁N₂O₂S Glutathione, 2188¹.
C₆H₁₁N₂NiO₂ Glyoxime, dimethyl-, Ni deriv., 795², 1248².
C₆H₁₁O₂ Cyclohexanone, dimethyl-, 1702², 2933².
 Heptenone, methyl-, 239², 1134², 2474².
 α-Hexenaldehyde, α-ethyl-, 1852².
 Δ²-Hexenone, 4-ethyl-, 2032².
 Ketene, dipropyl-, 1226².
 2-Octin-1-ol, 1244².
C₆H₁₁O₂ Butinethiol, tetramethyl-, 2651².
 Cycloheptanecarboxylic acid, 3252¹.
 Cyclohexanecarboxylic acid, 3252¹.
 Cyclohexanecarboxylic acid, methyl-, 3252¹.
 Cyclohexanone, 2-ethoxy-, 2644².
 Cyclopentanecarboxylic acid, 1,3-dimethyl-, and Cu salt, 640².
 3,5-Heptanedione, 4-methyl-, 1558², 2027².
 Δ¹-3-Heptenol, formate, 2331⁷.
 β-Pentenic acid, β-methyl-, Et ester, 1695².
C₆H₁₁O₂ Butyric anhydride, 3010².
 Cyclohexanecarboxylic acid, α-hydroxy-, and NH₄ salt, 982².
 Saponin from acid saponin from *Polygala amara*, 489².
C₆H₁₁O₂ Adipic acid, di-Me ester, *SnCl₄ and SnBr₄ addn. compds.*, 509, 511.
 Glutaric acid, β-ethyl-β-methyl-, 1802².
 Malonic acid, (methylbutyl-), 463², 464².
 Pseudoglucal, Et cycloacetal, 2478².
 Suberic acid, 2589², 3252²; Na salt, 1166¹.
 Succinic acid, α,α-diethyl-, 986¹.
C₆H₁₁O₂S Butyric acid, α,β-thiobis-, 923².
 Propionic acid, α-ethyl-α,β-thiobis-, 2639¹.
C₆H₁₁O₂S Acetic acid, ethylenedithiobis-, di-Me ester, complex salts, 3253², 3254².
C₆H₁₁O₂ Acetoacetic acid, α,γ-dimethoxy-, Et ester, 1141².
 Arabonolactone, trimethyl-, 1408².
 Ethanol, 2,2'-oxybis-, diacetate, 634².
 Propionic acid, β-carboxyoxo-, di-Et ester, 2039¹.
 Valeric acid, γ-hydroxy-α,β,δ-trimethoxy-, γ-lactone, 1409⁷.
C₆H₁₁O₂ Glycol, dibicarbonate, di-Et ester, 467².
C₆H₁₁O₂ α-Glucosyl-β-glucopyranoside, 4-methyl-, lactone, 1131².
 Tetraoxymethylene, diacetate, 1245².
C₆H₁₁O₂U + 2H₂O Uranyl acetate, 619².
C₆H₁₁Br 1-Octene, 2-bromo-, 633¹, 1850².

- C₆H₁₁BrN₂O₄ Malonamide, α -bromo-*N*-ethyl-*N'*-isopropyl-, 1696².
 Urea, α -(α -bromoisovaleryl)- β -ethyl-, 237⁴.
 C₆H₁₁BrO 4¹-Octanol, 7-bromo-, 633².
 C₆H₁₁ClO₂ 5-Trioxane, 2-(β -chloropropyl)-4,6-dimethyl-, 241².
 C₆H₁₁N Indole, perhydro-, 1862¹.
 C₆H₁₁NO (See also *Tropine*).
 Conhydrinone, 1280².
 Cyclopentanecarboxamide, 1,3 - dimethyl-, 647¹.
 Δ^2 -2-Heptenone, 3-methyl-, oxime, 239².
 Isopelletierine, 1280².
 C₆H₁₁NO₂ Acetoacetamide, β , β -diethyl-, 376¹.
 Cyclohexaneacetamide, α -hydroxy-, 982⁴.
 Tropine, *N*-oxide, and *HCl*, 2670².
 Valeric acid α -(dimethylaminomethyl)- γ -hydroxy-, lactone, -*HBr*, 3084⁴.
 C₆H₁₁NO₃ Tropine, *N*-sulfonated ether, 2670².
 C₆H₁₁N₂O Cyclopentanone, dimethyl-, semicarbazone, 239¹.
 Δ^2 -Pyrrolidine, ϵ 1-carbamyl-5-isopropyl-3-methyl-, 2666².
 C₆H₁₁N₂O₂ Cyclohexanone, 4-methoxy-, semicarbazone, 976².
 C₆H₁₁N₂O₂ Levulinic acid, α -ethyl-, semicarbazone, 3480².
 C₆H₁₁N₂ Bipyrrrolidine, 1310².
 Isobutyraldehyde, azine, 3478¹.
 Δ^2 -Pyrrolidine, 5-isobutyl-3-methyl-, 2666².
 C₆H₁₁N₂O₂ Hydrazine, *s*-diisobutyl-, 815².
 Isocaproamide, α -acetamido-, 2052¹.
 Malonamide, *N*-ethyl-*N'*-isopropyl-, 1696².
 Urea, α -ethyl- β -isovaleryl-, 237⁴.
 C₆H₁₁N₂O₂ Glycine, leucyl-, 302⁴, 2809².
 C₆H₁₁N₂O₂ Glutaramide, α , β , γ -trimethoxy-, 1409².
 C₆H₁₁N₂O₂ Piperazine, 1,4-diglycyl-, 2830².
 C₆H₁₁O Caprylaldehyde, 3261⁴.
 Cyclohexanol, 2,4-dimethyl-, 1702⁴.
 Heptanone, methyl-, 239⁴, 2474¹.
 Δ^2 -2-Heptenol, 2-methyl-, 1247⁴.
 2-Octanone, 1473².
 C₆H₁₁O₂ Caproaldehyde, α -ethyl- β -hydroxy-, 1842¹.
 Caproic acid, α -ethyl-, 3252¹.
 Caprylic acid, 1174¹, 1695¹, 3081⁴, 3396¹.
 1,2-Cyclohexanediol, 1,2-dimethyl-, 2817².
 Cyclohexanol, 2-ethoxy-, 2644².
 —, 2-(hydroxymethyl) - 4 - methyl-, 977¹.
 2-Heptanone, 4-hydroxy-3-methyl-, 239².
 3-Hexanone, 4 α -ethyl-4-hydroxy-, 822².
 Isocaproic acid, ethyl ester, 2214¹.
 Valeric acid, α -propyl-, 3252¹.
 C₆H₁₁O₂ Butyric acid, isopropoxymethyl ester, 2930⁴.
 Cyclohexanol, 2-(hydroxymethyl) - 4 - methoxy-, 977¹.
 Propionic acid, *sec*-butyloxymethyl ester, 2980⁴.
 C₆H₁₁O₂ Acetic acid, diethoxy-, Et ester, 1992².
 Pseudogucal, dihydro-, Et, cycloacetal, 2473⁴.
 C₆H₁₁O₂ γ -Arabinose, dimethyl-, 1409².
 C₆H₁₁O₂ Glucoside, dimethyl-, 250².
 2-Propanone, 1,3-dihydroxy-, Me cycloacetal, 247¹.
 C₆H₁₁O₂ Glucoheptonic acid, 4-methyl-, 3250⁴.
 C₆H₁₁Br Octane, 2-bromo-, 814¹.
 C₆H₁₁Cl Octane, 2-chloro-, 814¹.
 C₆H₁₁N (See also *Conine*).
 Cyclohexylamine, *N*, *N*-dimethyl-, 2196¹; and *HBr*, 2823².
 —, 2-ethyl-, and chloropropionate, 1862².
 Isobutylamine, *N*-isobutylidene-, 2645⁴.
 C₆H₁₁NO Conhydrine, 1280².
 Cyclohexanol, dimethylamino-, 2196¹.
 Isopelletierine, dihydro-, 1281¹.
 C₆H₁₁NO₂ Anhydro-base from diethyl acetal of β -aminopropionaldehyde, 656⁴.
 Butyramide, α -ethoxy- α -ethyl-, 1130¹.
 C₆H₁₁N₂O Caproaldehyde, β -methyl-, semicarbazone, 463².
 C₆H₁₁ (See also *Octane*).
 Hexane, dimethyl-, 464², 1073².
 C₆H₁₁BrTi Dibutylthallic bromide, 3439².
 C₆H₁₁ClTi Dibutylthallic chloride, 3439².
 Diisobutylthallic chloride, 3439².
 C₆H₁₁FTi Dibutylthallic fluoride, 3439².
 C₆H₁₁ITi Dibutylthallic iodide, 3439².
 C₆H₁₁NO₂Ti Dibutylthallic nitrate, 3439².
 Diisobutylthallic nitrate, 3439².
 C₆H₁₁N₂ Isobutyraldehyde, isobutylhydrazine, 3478¹.
 —, Propane, 1,1'-azobis[2-methyl-, 3478².
 C₆H₁₁N₂O Diisobutylamine, *N*-nitroso-, 3478².
 C₆H₁₁O Butyl ether, 1693².
 2-Heptanol, 3-methyl-, 280².
 Octanol, 814¹, 1473², 2427².
 Octyl alcohol, 2948¹.
 C₆H₁₁O₂ Acetaldehyde, di α -r acetal, 1556².
 Butyraldehyde, diethylacetal, 1694⁴.
 Isobutyraldehyde, diethylacetal, 1694⁴.
 C₆H₁₁O₂ Ether, bis(β -ethoxyethyl), 634².
 Orthoacetic acid, tri-Et ester, 237¹.
 C₆H₁₁O₂ Trional, 3488².
 C₆H₁₁IS Ethylidipropylsulfonium iodide, 1408².
 C₆H₁₁N₂ Diisobutylamine, and *HCl*, 3478².
 —, *HI*, 1403².
 C₆H₁₁NO 1 Butanol, 3-amino-2,2 diethyl-, 816².
 Hydroxylamine, α , β -dibutyl-, 2186⁴.
 C₆H₁₁NO₂ Propionaldehyde, α methylamino-, diethylacetal, 1709².
 C₆H₁₁BeClO₂, 3071¹.
 C₆H₁₁CIN Tetraethylammonium chloride, 1079².
 C₆H₁₁CINO Butoxybutylammonium chloride, 2186².
 C₆H₁₁Cl₂CrNO, 1385².
 C₆H₁₁Ge Germanium tetraethyl-, 1387², 2473².
 C₆H₁₁GeO Germanium tetraethoxy-, 2473².
 C₆H₁₁IN Diisobutylammonium triiodide, 1403².
 C₆H₁₁N₂ Hydrazine, *s*-diisobutyl-, and salts, 3478².
 C₆H₁₁O₂Ti Titanium ethoxide, 1247¹.
 C₆H₁₁Pb See *Plumbane*, tetraethyl-.
 C₆H₁₁Cl₂MnN₂, 1385².
 C₆H₁₁Cl₂MnN₂, 1385².
 C₆FeO₂, 1106².
 C₆H₁₁N₂ + 2H₂O Hydrometonic acid, 3228¹.
 C₆H₁₁N₂O₂ 3-Indolenitrile, 2,3-dihydro-3-hydroxy-5,7-dithio-2-keto-, 1422².
 C₆H₁₁N₂O₂ (2)-Benzazetegyloxylonitrile, 2-keto-, 2645⁴.
 C₆H₁₁O₂ 2,1-Benzopyran-1,3,4-trione, 265⁴.
 C₆H₁₁BrN₂O 2(1)-Benzofuranone, 4-bromo-1-isomito-5-methoxy-, Na deriv., 2047².
 C₆H₁₁BrO Umbelliferone, 3-bromo-, 2665².
 C₆H₁₁BrO₂ 2(1)-Benzofuranone, 1,1,4-tribromo-5-methoxy-, 2047².
 C₆H₁₁ClO₂ 2(1)-Benzofuranone, 1,1,4-trichloro-5-methoxy-, 2047².
 C₆H₁₁N₂O₂ 3-Indolealdehyde, 2,3-dihydro-5,7-dithio-2-keto-, 1422².
 C₆H₁₁BrN₂ Imidazole, 3,4(or 2,5)-dibromo-5(or 4)-phenyl-, 1700².
 C₆H₁₁BrO 2(1)-Benzofuranone, 1,4-dibromo-5-methoxy-, 2047².
 C₆H₁₁CrNO₂, 69².

- C_9H_7INO : Pseudoisatin, 5-iodo-1-methyl-, 506⁴.
 $C_9H_7INO_2$: Yatren, 1161¹, 3318².
 C_9H_7N : Indolenitrile, 279⁴, 505⁵, 506⁵.
 C_9H_7NO : Benzonitrile, 3-hydroxy-4-nitro-, acetate, 2340⁴.
Pseudoisatin, 1-methyl-5-nitro-, 65³.
 $C_9H_7NO_2$: Anisic acid, α -carboxy-3,5-dinitro-, 1417⁴.
 $C_9H_7NO_3$: Quinoline, 4-nitramino-6-nitro-, 2343¹.
 C_9H_8O : (See also *Coumarin*.)
Indandione, 66¹, 3486².
Propiolic acid, phenyl-, 2651².
 $C_9H_8O_2$: Phthalic anhydride, 4-methyl-, 990⁴.
 $C_9H_8O_3$: 1,2-Benzofurandione, 5-methoxy-, 2047³.
 $C_9H_8O_4$: Phthalonic acid, 265⁴.
 C_9H_7BrN : Imidazole, bromophenyl-, and salts, 1706⁴.
 C_9H_7BrNO : Isoindazole, 1-acetyl-, 509².
 $C_9H_7BrNO_2$: 5(4)-Isoxazolone, 3-*m*-bromoanilino-, 471³.
 C_9H_7BrO : Cinnamic acid, *m*-bromo-, 2475⁴.
 $C_9H_7BrO_2$: 2(1)-Enzofuranone, 4-bromo-5-methoxy-, 2047⁴.
 $C_9H_7BrO_3$: Glyoxylic acid, (5-bromo-2-hydroxy-*p*-anisyl)-, 2077².
 $C_9H_7BrNO_2$: Anthranilic acid, *N*-acetyl-4,5-dibromo-, 3262².
 $C_9H_7Br_2N$: 1,2,3-Triazole, 1-(2,4-dibromophenyl)-5-methyl-, 477¹.
 $C_9H_7ClNO_2$: 5(4) Isoxazolone, 3-*p*-chloroanilino-, 471³.
 $C_9H_7ClNO_3$: Benzaldehyde, 2-chloro-5-nitro-, oxime, *Ac* deriv., 2650².
Benzene, 1-(β -chloropropenyl)-2,4-dinitro-, 2938⁴.
 $C_9H_7Cl_2N$: 1,2,3-Triazole, 1-(dichlorophenyl)-5-methyl-, 477¹.
 $C_9H_7HgNO_3$: Benzoic acid, 2,4,6-trinitro-, ethylmercuric salt, 465⁴.
 $C_9H_7IN_2O_2$: Anthranilic acid, *N*-(cyanomethyl)-5-iodo-, 506³.
5(4)-Isoxazolone, 3-*p*-iodoanilino-, 471³.
 $C_9H_7IO_3$: Benzoic acid, 4-hydroxy-2-iodo-, acetate, 646³.
 C_9H_7N : See *Isoquinoline; Quinolinsine*.
 C_9H_7NO : Carbostyryl, 1572².
 $C_9H_7NO_2$: Benzoyl cyanide, *o*-methoxy-, 2916².
1,2-Indandione, 2-oxime, 2662².
6-Indolecarboxylic acid, 506².
Phthalimide, 4-methyl-, 990⁴.
Pseudoisatin, 7-methyl-, 1706².
2,4-Quinolmediol, 1572².
 $C_9H_7NO_2$: 2,5(3,4)-Oxazolidione, 3-phenyl-, 3083⁴.
 $C_9H_7NO_3$: 1,2-Benzofurandione, 5-methoxy-, 1-oxime, 2047⁴.
Cinnamic acid, nitro-, 2475⁴.
 $C_9H_7NO_4$: Anisic acid, α -carboxy-3-nitro-, 1417⁴.
 $C_9H_7NO_5$: Imidazole, 2-(nitrophenyl)-, and *-HNO_2*, 987³.
Quinoline, 2-amino-6-nitro-, 2342².
-, nitramino-, 2342².
1,2,5-Triazole-3-carboxylic acid, 4-phenyl-, 2205⁴.
 $C_9H_7NO_6$: 1,8-Imidazopyridine-2(3)-one, 3-nitroso-, *Ac* deriv., 1863¹.
 $C_9H_7NO_8$: Hydantoin, 3-(*p*-nitrophenyl)-thio-, 637².
 $C_9H_7NO_9$: Pyruvonitrile, β -keto- β -nitro-, α -c, β -phenylhydrazone, and isomer, 8¹.
 $C_9H_7N_2S$: 4-Triazino-benzimidazolemercaptan, 1,2-dihydro-2-imino-, 45⁴.
 C_9H_8 : (See also *Indene*.)
Benzene, propargyl-, 3276².
 C_9H_8BrCl : Benzene, 1-bromo-4- γ -chloroallyl-, 2645¹.
 C_9H_8BrClO : Acetophenone, 5-bromo- α -chloro-2-hydroxy-4-methoxy-, 2047².
 C_9H_8BrNO : Hydrocinnamonitrile, α -bromo-, 485⁴, 1260⁴.
 $C_9H_8BrNO_2$: Malonanilic acid, *m*-bromo- β -thio-, 471⁷.
 $C_9H_8BrNO_3$: Benzoic acid, 4-acetamido-2-bromo-, 1250³.
 $C_9H_8BrNO_5$: 5-Pyrazolone, 3-*m*-bromoanilino-, 471³.
 $C_9H_8Br_2N_2S$: 1,3,4-Thiadiazole, 2-(*p*-bromophenylimino)-2,3-dihydro-5-methylmercapto-, 988⁴.
 $C_9H_8Br_2O$: Anisole, *p*-(α,β -dibromovinyl)-, 3265¹.
 $C_9H_8Br_2Cl$: Benzene, 1-bromo-4-(β,γ -dibromo- γ -chloropropyl)-, 2645².
 C_9H_8ClNO : Hippuryl chloride, 2041².
 $C_9H_8ClNO_2S$: Malonanilic acid, *p*-chloro- β -thio-, 471⁷.
 $C_9H_8ClNO_5$: 5-Pyrazolone, 3-*p*-chloroanilino-, 471³.
 $C_9H_8HgO_3$: Benzoic acid, *o*-carboxymethoxy-(γ -hydroxymercuri-, *ds* Na salt, P 453⁴.
 $C_9H_8INO_3S$: Malonanilic acid, *p*-iodo- β -thio-, 471⁷.
 $C_9H_8INO_5$: Anthranilic acid, *N*-acetyl-5-iodo-, 506⁷.
 $C_9H_8INO_6$: Anthranilic acid, *N*-(carboxymethyl)-5-iodo-, 506⁹, 1422².
 $C_9H_8IN_2O_5$: 5-Pyrazolone, 3-*p*-iodoanilino-, 471³.
 C_9H_8Na : α -Tolunitrile, 1-methyl-, Na deriv., 51³.
 C_9H_8N : Cinnamonitrile, β -amino-, 245⁴.
Imidazole, 4(or 5)-phenyl-, 1706⁴.
Pyrazole, 3(or 5)-phenyl-, and *-HNO_2*, 2049⁴, 45.
Quinoline, amino-, 2342², *mono- and di-HCl*, 1250¹.
Quinoxaline, 2-methyl-, 218².
 C_9H_8NO : Furan, 3-methyl-4-phenyl-, 262².
Indazole, 3-acetyl-, 508².
Isoindazole, 1-acetyl-, 568⁸.
 $C_9H_8NO_2$: Anthranilic acid, *N*-(cyanomethyl)-, 2822².
1,4-Imidazopyridin-2(3)-one, α -acetyl-, 1863¹.
3(1)-Indazolone, 2-acetyl-, 508².
3-Isoindazolol, 1-acetyl-, 508⁸.
3,5-Pyrazolodione, 1-phenyl-(γ), 1254³.
5-Pyrazolone, 3-hydroxy-1-phenyl-(γ), 1254³.
1,5,2-Pyridopyrimidine, 2,4(3)-dione, 3-methyl-, 70².
2,4(1,3) Quinazolinodione, 1-methyl-, 1282².
 $C_9H_8NO_3$: Hydantoin, (*p*-hydroxyphenyl)-, 637², 14.
2,6-Xylnitrile, 4-hydroxy-3-nitro-, 2340¹.
 $C_9H_8NO_4$: 1,2-Propanedione, 1-(*o*-nitrophenyl)-, 1-oxime, 2938⁴.
 $C_9H_8NO_5$: Anthranilic acid, *N*-acetyl-3-nitro-, 3262².
 $C_9H_8NO_6$: *o*-Cresol, 4,6-dinitro-, acetate, 1133⁴.
 $C_9H_8NO_8$: Urazole, 4-benzalaminothio-, 2206⁴.
 $C_9H_8NO_9S$: 1,3,4-Thiadiazole-2-mercaptan, 4,5-dihydro-4- α -nitroso-5- β -tolylimino-, 988⁴.
 $C_9H_8NO_9$: Pseudoisatin, 1-methyl-5-nitro-, hydrazone, 65⁴.

- C₈H₈O** Cinnamaldehyde, 265^o, 821^o, 3261^o.
Ketene, methylphenyl-, 2658^o.
2-Propin-1-ol, 3-phenyl-, 1244^o.
- C₈H₈O₂** (See also *Cinnamic acid*.)
Acrylic acid, Ph ester, 267^o.
Atropic acid, 1134^o.
1-Indanone, 2-hydroxy-, 661^o.
Ketene, methylphenyl-, monoxide, 2658^o.
C₈H₈O₃ *o*-Coumaric acid, 2475^o.
Hydrocoumarin, 5-hydroxy-, 2039^o.
Umbelliferone, 3,4-dihydro-, 2039^o.
- C₈H₈O₄** (See also *Acetylsalicylic acid*.)
3,6 - Benzofurandione, 1,2 - dihydro - 5 - methoxy-, 484^o.
Caffeic acid, 2475^o.
Cinnamic acid, 3,5-dihydroxy-, 51^o, 2651^o.
Pyruvic acid, *p*-hydroxyphenyl-, 1878^o.
- C₈H₈O₅** Anisic acid, α -carboxy-, 1417^o.
Glyoxylic acid, 2-hydroxy-*p*-anisyl-, 2047^o.
 α - Toluic acid, α - hydroxy - 3,4 - methylene-dioxy-, 264^o.
- C₈H₇BrClNO** Benzoic acid, 4-amino-2-bromo-, β -chloroethyl ester, 2332^o.
- C₈H₇BrClNO** Tyrosine, bromochloro-, 2817^o.
- C₈H₇BrN** Indazole, 3-bromo-2,5-dimethyl-, 512^o.
Isoindazole, 3-bromo-1,5-dimethyl-, 512^o.
C₈H₇BrN₂O Tyrosine, bromonitro-, 2817^o.
- C₈H₇BrO** Propiophenone, α -bromo-, 503^o.
C₈H₇BrO Hydrocinnamic acid, β -bromo-, 483^o, and *NH₄ salt*, 3262^o.
- C₈H₇BrNO** Acetamide, *N* - (2,4 - dibromo - *o* - tolyl), 512^o.
- C₈H₇BrN₂** Dibromo-1,2-dimethyl-2-isoindazolium bromide, 512^o.
- C₈H₇ClN₂O** Tyrosine, chloronitro-, 2817^o.
- C₈H₇ClO** Indanol, chloro-, 2032^o.
- C₈H₇ClO₂** *o*-Cresol, α -chloro-, acetate, 2343^o.
Hydratropic acid, β -chloro-, 1134^o.
- C₈H₇Cl₂NO** *o*-Acetotoluide, α , α -dichloro-, 1557^o.
- C₈H₇Cl₂NO** Tyrosine, dichloro-, 57^o.
- C₈H₇I₂NO** Tyrosine, diiodo-, 359^o, 1311^o, 1901^o, 1167^o.
- C₈H₇N** (See also *Skatole*.)
Indole, methyl-, 280^o, 830^o, 1462^o.
 α -Toluylnitrile, *p*-methyl-, 277^o.
- C₈H₇NO** Cinnamamide, 3253^o.
Pseudoisindole, 1(or 3)-methoxy-, 2938^o.
2,6-Xylnitrile, 4-hydroxy-, 2340^o.
- C₈H₇NO₂** Benzamide, *N*-acetylthio-, 3087^o.
C₈H₇NO₂ 2,3,1-Benzoxazine, 1-methoxy-, 2937^o.
Glycine, *N*-benzyl-, *salts*, 2434^o, 2639^o.
Phthalimidine, 2-methoxy-, 2937^o.
Pseudoisindole, 1(or 3)-methoxy-, 2-oxide, 2937^o.
- C₈H₇NO₂** (See also *Hippuric acid*.)
Benzamide, hydroxy-, acetate, 1417^o.
Glycine, *N*-salicylal-, *Ba salt*, 2639^o.
Glyoxyhydroxamic acid, *p*-tolyl-, *Na salt*, 286^o.
2-Propanone, 1-(*o*-nitrophenyl)-, 2938^o.
- C₈H₇NO₃** *o*-Cresol, nitro-, acetate, 1133^o.
Glycolhydroxamic acid, benzoate, and *salts*, 240^o.
Onizacol, 4-(β -nitrovinyl)-, 1701^o.
Salicyluric acid, 665^o, 2530^o, 2531^o.
- C₈H₇NO₄** Acid, m. 200^o, from 4-ethoxy-2,6-lutidine, and *deriv.*, 2342^o.
Benzaldehyde, 2,4 - dimethoxy - 5 - nitro-, 1701^o.
Glycol, mono-*p*-nitrobenzoate, 3262^o.
o-Veratraldehyde, nitro-, 2629^o.
- C₈H₇NO₅** Anisic acid, 2-hydroxy-5-nitro-, *Me ester*, 1701^o.
- C₈H₇NS** Benzothiazoline, 2 - methyl - 1 - methylene-, 2054^o.
- C₈H₇N₂** 1,2,3 - Triazole, 4 - methyl - 1 - phenyl-, 2341^o.
—, 1-*o*-tolyl-, 476^o.
- C₈H₇N₂O** Indazole, 3-acetyl-, oxime, 508^o.
 Δ^2 -Pyrazoline, nitroso-3-phenyl-, 2837^o.
- C₈H₇N₂O₂** Anthranilicnitrile, *N,N*-dimethyl-5-nitro-, 819^o.
—, *N*-ethyl-5-nitro-, 819^o.
- C₈H₇N₂O₂** 2-Propanone, 1-(2,4-dinitrophenyl)-, oxime, 2938^o.
- C₈H₇N₂S** 1,4,3 - Isothiadiazine, 2 - amino - 5 - phenyl-, and *salts*, 831^o.
2(3) - Thiazolone, 4 - phenyl-, hydrazone, 832^o.
- C₈H₇N₂S** 1,3,4 - Thiodiazole - 2 - mercaptan, 4,5 - dihydro - 5 - *p*-tolylimino-, 988^o.
- C₈H₇N₂O₂** Δ^2 -Oxazoline, 2-amino-, picrate, 2052^o.
- C₈H₈** Benzene, allyl-, 1261^o.
—, propenyl-, 1261^o.
Hydrindene, 11^o.
Indan, 827^o.
Styrene, α -methyl-, 1401^o.
- C₈H₈AsNO** Benzoic acid, 3-acetamido-4-arsono-, 479^o.
- C₈H₈BrNO** *m*-Acetotoluide, 4 bromo-, 1259^o.
Hydrocinnamamide, α -bromo-, 485^o, 1260^o.
- C₈H₈BrNO** Benzoic acid, 4-amino-2 bromo-, *Et ester*, 2332^o.
- C₈H₈BrNO** Tyrosine, bromo-, 2817^o.
- C₈H₈BrNS** 1,2-Dimethylbenzothiazolium bromide, 2054^o.
- C₈H₈BrN₂** Acetone, (dibromophenyl)hydrazone, 474^o.
- C₈H₈Br₂O** Toluene, 2,6 - dibromo - 3,5 - di-methoxy-, 1260^o.
- C₈H₈Br₂O₂** Acetic acid, *p*-tolylselenyl-, di-bromide, 3260^o.
- C₈H₈Br₂O₂** α , α' -Mesitylenediol, 4,6-dibromo-2 hydroxy-, 1700^o.
- C₈H₈Br₂O₂** Acetic acid, *p*-tolylselenyl-, tetra-bromide, 3260^o.
- C₈H₈ClNO** Acetotoluide, *N*-chloro-, 1132^o.
- C₈H₈ClNO** *m* - Acetotoluide, 5 - chloro - 6 hydroxy-, 1562^o.
- C₈H₈ClNO** Tyrosine, chloro-, 57^o, 2817^o.
- C₈H₈CrNO₂** 69^o.
- C₈H₈HgN₂O** Aniline, 2 - hydroxymercuri - *N* methyl 4-nitro-, acetate, 326^o.
- C₈H₈HgO₂** Methylxanthic acid, *p*-tolylmercuric deriv., 465^o.
- C₈H₈I₂NO** 1,2 - Dimethylbenzoxazolium iodide, 2054^o.
- C₈H₈INS** Benzothiazole, 1 - methyl-, methia-dide, 2339^o.
- C₈H₈I₂N** 3 - Iodo - 1,2 - dimethyl - 2 - iso-indazolium iodide, 512^o.
- C₈H₈IN** Indazole, 2-ethyl-, 3091^o.
- C₈H₈NO** 2,6-Xylnitrile, 3-amino-4-hydroxy-, 2340^o.
- C₈H₈N₂O** 1,2 - Propanedione, 1 - phenyl-, dioxime, 262^o.
- C₈H₈N₂O** Carbanilic acid, *p* nitroso-, *Et ester*, 480^o.
Glyoxyhydroxamic acid, *p*-tolyl-, oxime-, 286^o.
- Nicotinic acid**, 2-acetamido-, *Me ester*, 518^o.
2 - Propanone, 4 - (*o* - nitrophenyl)-, oxime-, 2938^o.
o-Toluidine, *N*-methyl-*o*-nitro-, 9038^o.

- C₈H₁₀N₂O₂** Acid, m. 147°, from 4-ethoxy-3-nitro-2,6-lutidine, and salts, 2342.
Benzaldehyde, 2,4-dimethoxy-5-nitro-, oxime, 1701².
o-Veratraldehyde, nitro-, oxime, 4824².
C₈H₁₀N₂O₄ Tartaromtrile, methyl-, diacetate, 248².
C₈H₁₀N₂S Benzothiazole, 5 - dimethylamino-, 513².
C₈H₁₀N₂S Benzothiazole, 5 - dimethylamino - 1 - mercapto-, 513².
C₈H₁₀N₂O Phthalaldehyde, oxime semicarbazone, 2937².
C₈H₁₀N₂O₂ 1,2 - Propanedione, 1 - (o - nitrophenyl)-, 1 - oxime 2 - hydrazone, 2938².
C₈H₁₀N₂O₂ 2 - Propanone, 1 - (2,4 - dinitrophenyl)-, hydrazone, 2938².
C₈H₁₀N₂O₂ Benzoic acid, 4-hydrazino-3,5-dinitro-, Et ester, 2824².
C₈H₁₀O Cinnamic alcohol, 265², 1401², 2040².
Hydrocinnamaldehyde, 3261².
2-Propanone, 1-phenyl-, 1899².
Propiophenone, 1899².
Styrene, α-methoxy-, 2035².
α-Tolualdehyde, p-methyl-, 3261².
C₈H₁₀O (See also *Hydrocinnamic acid*.)
Acetic acid, benzyl ester, 1599².
Benzoic acid, ethyl ester, 1301², 2648².
Butyraldehyde, α-2-fural-, 1139².
Cresol, acetate, 516².
1,2-Indandiol, 971².
C₈H₁₀OSe Acetic acid, p-tolylselenenyl-, 3260².
C₈H₁₀O Atrolactic acid, 1701².
Benzoic acid, hydroxy-, Et ester, 3483².
2,4-Cresotic acid, Me ester, 51².
Glycol, monobenzoate, 3262².
Hydracrylic acid, β-phenyl-, 483².
Rotenic acid, 3483².
Salicylic acid, Et ester, 2648².
Tuba acid, 1708².
o-Veratraldehyde, 482².
C₈H₁₀OSe Acetic acid, p-tolylselenyloxy-, 3260².
C₈H₁₀O 3,6-Benzoxurandiol, 1,2-dihydro-5-methoxy-, 484².
Glycol, monosalicylate, 3262².
Hydrocinnamic acid, 2,6-dihydroxy-, 2030².
Salicylaldehyde, 4,6-dimethoxy-, 2041².
o-Veratric acid, 1134².
C₈H₁₀O 1,2,4-Butanetricarboxylic acid, 2-hydroxy-3,3-dimethyl-, γ-lactone, 1,2-anhydride, 2429².
C₈H₁₀BrN 1,2-Dimethylindazolium bromide, 3091².
C₈H₁₀BrN₂O Uridine, 5-bromo-, 2055².
C₈H₁₀BrO Veratrole, (bromomethyl)-, 2668², 2669².
C₈H₁₀Cl Benzene, (α-chloropropyl)-, 2324².
C₈H₁₀ClN 1,2-Dimethylindazolium chloride, 3091².
C₈H₁₀ClO Anisole, 4-chloro-3,5-dimethyl-, 2339².
Ether, benzyl β-chloroethyl, 2640².
C₈H₁₀ClS Sulfide, β-chloroethyl p-tolyl, 1555².
C₈H₁₀HgNO m-Toluidine, 4-acetoxymethyl-, 49².
C₈H₁₀N Benzalimine, o,o-dimethyl-, 2817².
Indanamine, 1520², 1522².
Isoquinoline, 1,2,3,4-tetrahydro-, 824².
C₈H₁₀NO Acetamide, N-methyl-, 1270².
Acetophenone, methyl-, oxime, 1405².
Acetotoluide, 3185².
Benzaldehyde, dimethylamino-, 821², 1828².
Hydrocinnamamide, 3253².
Propiophenone, oxime, 982².
C₈H₁₀NO Acetanilides thio-, 471².
C₈H₁₀NO (See also *Benzocaine*.)
Acetophenone, hydroxymethyl-, oxime, 1405².
—, m (and p)-methoxy-, oxime, 1405².
Alanine, phenyl-, 38², 1128².
Anthranelic acid, Et ester, addn. compds., 32514².
—, N-ethyl-, 2648².
Benzoic acid, p-amino-, Et ester, 1411².
Butyraldehyde, α-2-fural-, oxime, 1139².
o-Cresol, 6-ethyl-4-nitroso-, 270².
Hydracrylamide, β-phenyl-, 3262².
Hydratropic acid, β-amino-, 1134².
Tropamide, 1135².
C₈H₁₀NO (See also *Tyrosine*.)
Acid, m. 138², from 4-ethoxy-2,6-lutidine, and derivs., 2342².
Cinnamic acid, NH₄OH salt, 2928².
o-Cresol, 6-ethyl-4-nitro-, 271².
Glycol, mono-p-aminobenzoate, 3262²; mono-carbanilate, 3262².
3,4,5-Hemimelliteneol, 2-nitro-, 2340².
Serine, β-phenyl-, 76².
C₈H₁₀NO 3,4-Pyrroledicarboxylic acid, 1,2,5-trimethyl ester, 2451².
Serine, β-(β-hydroxyphenyl)-, 76².
C₈H₁₀NO Serine, β-(3,4-dihydroxyphenyl)-, 73².
C₈H₁₀NS m-Acetotoluide, thio-, 471².
C₈H₁₀NS Carbanilic acid, ethylthio-, salts, 973².
C₈H₁₀N₂O Guanidine, α (or β)-benzoyl-, (or α)-methyl-, and -HCl, 1533².
C₈H₁₀N₂O Biuret, methyl-1-phenyl-, 973².
Propionaldehyde, α-2-fural-, semicarbazone, 113².
C₈H₁₀N₂O 2-Propanone, 1,3-dihydroxy-, p-nitrophenylhydrazone, 248².
C₈H₁₀N₂S Benzothiazoline, 5-dimethylamino-2-imino-, 513².
C₈H₁₀ (See also *Mentylene*.)
Benzene, propyl-, 977², 1899².
Cumene, 1899².
Indan, 3,7-dihydro-, 1262².
Toluene, o-ethyl-, 3260².
C₈H₁₀AsNO Carbanilic acid, arsonio-, Et ester, 979².
—, 5-arsono-2-methyl-, Me ester, 979².
C₈H₁₀Br₂O 1,2-Cyclopropanedicarboxylic acid, 2,3-dibromo-3-methyl-, Et Me ester, 1410².
C₈H₁₀Cl₂N₂O Pyridine, 2-amino-, bischloroacetate, 1463².
C₈H₁₀N Benzene, isopropyl-, 642².
Cyclohexanecetonitrile, 1-cyano-, 268².
C₈H₁₀N₂O (See also *Dulcin*.)
Athramil, 2-acetamido-3,4,5,6-tetrahydro-, 1262².
C₈H₁₀N₂O Barbituric acid, 5-allyl-, 5-ethyl-, 2641².
2,6-Lutidine, 4-ethoxy-3-nitro-, 2342².
C₈H₁₀N₂OS Hydrazine, α-acetyl-β-tolyl-sulfonyl-, 260².
C₈H₁₀N₂O Hippuric acid, NH₄OH salt, 2928².
2,5-Pyrazinediol, 3,6-dihydro-3-methyl-, diacetate, 995².
2,5-Pyrazinedione, 4,4-diacetyl-3-methyl-, 995².
C₈H₁₀N₂O Uridine, 2065².
C₈H₁₀N₂S Urea, thio-2,5-xylyl-, 2481².

- C₆H₁₂N₄O₂ Uric acid, 1,3,7,9-tetramethyl-, 2811¹.
- C₆H₁₂N₄O₂ Hydantoin, 5,5'-uricobis[5-methyl-, 637¹.
- C₆H₁₂O *o*-Crtol, 0-ethyl-, 270¹.
Ether, benzyl ethyl-, 2194¹.
Phenetole, methyl-, 2648².
1-Propanol, 3-phenyl-, 1244¹.
- C₆H₁₂O₈ Ethanol, 2-(benzylmercapto)-, 1557².
- C₆H₁₂O₂ Anisyl alcohol, α -methyl-, 58¹.
Benzaldehyde, dimethylacetal, 1694¹.
Divarinal, 481¹.
Ethanol, 2-benzyloxy-, 2640¹.
2-Furancarbinol, bityrate, 987¹.
Phenetole, α -methoxy-, 2648².
- C₆H₁₂O₁ Ethanol, 2-(*m*-methoxyphenoxy)-, 1421¹.
Isophthalyl alcohol, 2-hydroxy-5-methyl-, 3125¹.
Tuba acid, dihydro-, 1708¹.
- C₆H₁₂O₃ Ethanol, 2-(benzylsulfonyl)-, 1557².
p-Toluenesulfonic acid, Et ester, 1850¹, 2647².
- C₆H₁₂O₄ Caronic acid, 1-ethyl-2-hydroxy-, β -lactone, 1697¹.
Compd., m. 208°, from the di-Et ester of α , γ -dibromo- α -ethyl- β , β -dimethyl glutaric acid and KOH, 1697¹.
 Δ^1 2-Cyclopropenedicarboxylic acid, 3-methyl-, Et Me ester, 1410¹.
Glutaric anhydride, β -keto- α , α , γ , γ -tetra-methyl-, 2188¹.
Isophthalyl alcohol, 2-hydroxy-5-methoxy-, 977¹.
- C₆H₁₂O₅ 1,2,4-Butanetricarboxylic acid, 2-hydroxy-3,3-dimethyl- γ -lactone, 2329¹.
- C₆H₁₂O₇ Tricarhallic acid, β -(hydroxymethoxy)-, *sym*-lactone, di-Me ester, 3256¹, mono-Et ester, 3256¹.
- C₆H₁₂S Sulfide, benzyl ethyl-, 1850¹.
—, *o*-ethylphenyl methyl-, 1412¹.
—, ethyl *p*-tolyl-, 1850¹.
- C₆H₁₂BrO₂ Glutaric acid, bromo- α -ethylhydroxy- β , β -dimethyl (?), γ -lactone, 1697¹.
- C₆H₁₂N⁺ Aniline, *N*-ethyl-*N*-methyl-, 2811¹.
—, *N*-propyl-, 2614¹.
Benzylamine, *N*,*N*-dimethyl-, 1520¹.
—, ethyl-, 1520¹.
Pyridine, 2,6-diethyl-, and *derivs.*, 2667¹.
—, 3-ethyl-2,6-dimethyl-, and *chloroplatinate*, 1573¹.
Toluidine, *N*-ethyl-, 2648¹.
2,4-Xylidine, *N*-methyl-, 2192¹.
- C₆H₁₂NO α -Anisidine, *N*-ethyl-, 2648¹.
Cyclohexanenitrile, 1-ethyl-2-keto-, 1262¹.
 Δ^1 -Cyclohexenenitrile, 2-ethyl-, 1262¹.
3,4,5-Hemimellitrol, 2-amino-, 2340¹.
Isoneudocumenol, 6-amino-, 2340¹.
Phenethylamine, *m*-methoxy-, *salts*, 990¹.
Phenol, *p*-isopropylamino-, P 3492¹.
- C₆H₁₂NO₂ 3-Pyrrolicarboxylic acid, 2,5-dimethyl-, Et ester, 1420¹.
—, 1,2,4,5-tetramethyl-, 2451¹.
3-Pyrrolicpropionic acid, 2,4-dimethyl-, 2336¹.
1, α -Spin[cyclohexane-succinimide], 268¹.
- C₆H₁₂NO₂ (See also *Adrenaline*.)
Cyclopropanecarboxylic acid, 1-(α -cyano- α -hydroxyethyl)-, ethyl ester, 2809¹.
Hydroxamic acid, NH₂OH salt, 6928¹.
- C₆H₁₂N₂ Acetimidic acid, β -methyl- β -phenyl-hydrazide, and -H₂Cl₂, 26¹.
- C₆H₁₂N₂O Indazole, 2-carbamyl-, 977¹.
- C₆H₁₂N₂O₂ 3-Pyrrolicarboxylic acid, 1-carbamido-, 2,4,5-trimethyl ester, 2451¹.
- C₆H₁₂ Cyclohexane, propargyl-, 3476¹.
- C₆H₁₂BrO₂ Glutaric acid, α , γ -dibromo- α -ethyl-, β , β -dimethyl-, 1697¹.
- C₆H₁₂Cl₂CrNO₂ 1385¹.
- C₆H₁₂N₂ Hydrazine, α -isopropyl- β -phenyl-, and -HCl, 642¹.
- C₆H₁₂N₂O Anthranil, 2-dimethylamino-3,4,5,6-tetrahydro-, and -HBr, 1262¹.
Cyclohexanenitrile, 1-ethyl-2-keto-, oxime, 1262¹.
2,6-Lutidine, 3-amino-4-ethoxy-, and *derivs.*, 2342¹.
- C₆H₁₂N₂O₂ 3-Pyrrolicarboxylic acid, 1-amino-2,5-dimethyl-, Et ester, 1420¹.
- C₆H₁₂N₂O₂ Barbituric acid, 5-isoamyl-, 2641¹.
4-Pyridazinecarboxylic acid, 2,3,4,5-tetrahydro-3-keto-4,6-dimethyl-, Et ester, 3480¹.
- C₆H₁₂N₂O₃ Aniline-2-thiosulfonic acid, 1-amino-4-*N*-dimethyl-, Me ester, 513¹.
—, 1-amino-4-ethyl-5-methyl-, 513¹.
- C₆H₁₂N₂O₂ Tartaric acid, α -methyl-, diacetate, 248¹.
- C₆H₁₂N₂ Tripropylamine, γ , γ , γ -tri-amino-, *salts*, 3480¹.
- C₆H₁₂N₂O Cyclohexanenitrile, 2-keto-1-methyl-, semicarbazone, 1262¹.
2-Indazolecarboxamide, 3-amino-4,5,6,7-tetrahydro-7-methyl-, 1262¹.
- C₆H₁₂N₂O₂ (See also *Carnosine*.)
Histidine, *N*-alanyl-, 1248¹.
- C₆H₁₂O Δ^1 -Cyclohexenone, 3-ethyl-2-methyl-, 3266¹.
 β -Fenchocamphorone, 55¹.
Isocamphenilone, 2946¹.
Isophorone, 3087¹.
 Δ^1 -2-Noninone, 2953¹.
Nopinone, 487¹.
Phorone, 484, 1662¹, 2771¹.
- C₆H₁₂O₂ α -Carnophytic acid, 2943¹.
Cyclohexanecetic acid, 2-hydroxy-4-methyl-, lactone, 2647¹.
 Δ^1 (α)-Cyclohexanecetic acid, 4-methyl-, 1136¹, 3252¹.
 Δ^1 -Cyclohexanecetic acid, 4-methyl-, 3252¹.
2-Furancarbinol, α -butyl-, 1564¹.
- C₆H₁₂O₂ Lactone, m. 103°, from *Alstonia congensis* bark, 2954¹.
- C₆H₁₂O₂ Cyclohexanecetic acid, 1-carboxy-, 268¹.
1,1-Cyclopentanediactic acid, 1802¹.
Glutaric acid, α -ethyl- α -hydroxy- β , β -dimethyl-, γ -lactone, 1697¹.
Malonic acid, ethylidene-, di-Et ester, 503¹.
- C₆H₁₂O₂ Compd., m. 85°, from AcCl and residue from Δ^1 -2-butenone prepn. mixture, 650¹.
2-Furanmethanediol, tetrahydro-, diacetate, 278¹.
Glutaric acid, α -ethyl- α , γ -dihydroxy- β , β -dimethyl-, γ -lactone, 1697¹.
Lactone, b.p. 210°, from chenopodium oil, 2943¹.
Oxalacetic acid, methyl-, di-Et ester, 2478¹.
- C₆H₁₂O₂ Lactic acid, dilactyl-, 3082¹.
- C₆H₁₂O₂ Glycerol, tricarboxylate, tri-Me ester, 468¹.
- C₆H₁₂BrNO₂ Cyclohexanecetic acid, bromo-, uride, P 3351¹.
- C₆H₁₂BrO₂ Malonic acid, (β -bromoethyl)-, diethyl ester, 2809¹.
- C₆H₁₂Cl β -Fenchocamphoryl chloride, 56¹.

- $C_8H_{11}NO$ Pseudopelletierine, 522⁸.
 $C_8H_{11}NO_2$ Hydroecgonidine, 2671⁸.
 Oxazole, 5-ethoxy-2-isobutyl-, 2051⁸.
 —, 5-ethoxy-4-isopropyl-2-methyl-, 2051⁸.
 $C_8H_{11}NO_2$ (See also *Ecgonine*.)
 Cyclohexanecarboxylic acid, 1-acetamido-(?), 286⁸.
 Homoisopilopamide, *N*-methyl-, 1281⁸.
 Homopilopamide, *N*-methyl-, 1281⁸.
 $C_8H_{11}N_2O_2$ Cyclopropanecarboxylic acid, 1-acetyl-, ethyl ester, semicarbazone, 2809¹.
 $C_8H_{11}N_2O_2$ Malonic acid, acetonylethyl-, semicarbazone, 3480⁸.
 Suberic acid, α -keto-, semicarbazide, 1560¹.
 C_8H_{11} 1,3-Heptadiene, 3-ethyl-, 1852⁸.
 Indan, hexahydro-, 1262⁸.
 Nonine, 3276⁸.
 $C_8H_{11}CuO_2$ Δ^1 -3-Heptenone, 5-hydroxy-4-methyl-, methoxycopper salt, 1558⁷.
 $C_8H_{11}N_2$ Pyrazole, 5-amyl-3-methyl-, 2953⁸.
 $C_8H_{11}N_2O_2$ Cyclohexanacetamide, 1-carbamyl-, 268⁸.
 Cyclohexanecetic acid, ureide, P 3351⁷.
 Hydantoin, 5,5-dipropyl-, 3761⁸.
 —, 5-ethyl-5-isobutyl-, 3761⁸.
 2,5-Piperazinedione, 3-isobutyl-6-methyl-, 2810¹.
 $C_8H_{11}N_2O_2$ Glycine, *N*, *N'*-thiocarbonylbis-, di-Et ester, 637⁸.
 $C_8H_{11}N_2O_2$ Aspartic acid, *N*-alanyl-, di-Me ester, 1248⁸.
 $C_8H_{11}N_2O_2$ Hydrazinetetracarboxylic acid, tri-Et ester, 1424⁸.
 $C_8H_{11}N_2O$ Pyridine, 3-acetyl-1,2,5,6-tetrahydro-1-methyl-, semicarbazone, 656⁸.
 $C_8H_{11}N_2O_2$ Glycine, alanyldiglycyl-, 2503⁸.
 $C_8H_{11}O_2$ Cyclohexanone, trimethyl-, 3087⁸.
 β -Fenchocamphorol, 55⁸.
 Δ^1 -3-Heptenone, 2,6-dimethyl-, 2474⁴.
 Δ^1 -5-Nonenone, 466⁸.
 Octenone, methyl-, 466⁸, 2474⁴.
 $C_8H_{11}O_2$ Cyclohexanecetic acid, 4-methyl-, 3252¹.
 Cyclohexanecarboxylic acid, Et ester, 2040⁸.
 Cyclohexanepropionic acid, 3252¹.
 3,5-Heptanedione, 2,6-dimethyl-, 2027⁸.
 Δ^1 -3-Heptenol, acetate, 2331⁷.
 α -Pentenic acid, β -ethyl-, Et ester, 1695⁷.
 $C_8H_{11}O_2$ Cyclohexanecetic acid, α -hydroxy-, Me ester, 982⁸.
 Levulinic acid, α -isobutyl-, 3480⁷.
 $C_8H_{11}O_2$ Acid of lactone from *Alstonia* bark, *Na* salt, 2958⁸.
 Azelaic acid, *Na* salt, 1166¹.
 Glutaric acid, β , β -diethyl-, 1802⁸.
 Malonic acid, ethyl-, di-Et ester, 2641⁸.
 Pimelic acid, di-Me ester, *SnCl_4* addn. compd., 60⁸.
 $C_8H_{11}O_2$ Acetic acid, trimethylenedithiobis-, di-Me ester, 1407⁸.
 $C_8H_{11}O_2$ Cellulose, trimethyl-, 1410⁸.
 $C_8H_{11}O_2$ Fructose, monoacetone-, 249⁸.
 Galactose, monoacetone-, 2642⁷.
d-Glucose, 3-allyl-, 2035¹.
 Glutaric acid, α -hydroxy- β -(γ -hydroxybutyl)-, *Be* and *Na* salts(?), 2943⁸.
 Malonic acid, bis(β -hydroxypropyl)-, dilactone, 2640⁷.
 —, bis(β -methoxyethyl)-, 2640⁸.
 $C_8H_{11}O_2$ Glycerol, dibicarbonate, di-Et ester, 4681⁸.
 $C_8H_{11}O_2$ Pentaerythylene diacetate, 1245⁸.
 $C_8H_{11}BrN_2O_2$ Malonamide, α -bromo-*N*, *N'*-diisopropyl-, 1866⁸.
 $C_8H_{11}NO$ Conhydrinone, methyl-, and *HBr*, 1280⁸.
 Isopelletierine, methyl-, 1280⁷.
 $C_8H_{11}NO_2$ Glycine, *N*-isovaleryl-, Et ester, 2051⁷.
 Valine, *N*-acetyl-, Et ester, 2051⁷.
 $C_8H_{11}N_2O$ Heptenone, methyl-, semicarbazone, 239⁸, 2474⁴.
 Δ^1 -2-Hexenone, 4-methyl-, semicarbazone, 2032⁸.
 Δ^1 -Pyrazoline, 1-carbamyl-5-isobutyl-3-methyl-, 2660⁸.
 $C_8H_{11}N_2O_2$ 1,2,3-Propanetriamine, *N*¹, *N*¹, *N*¹-triacyl-, 1827⁸.
 $C_8H_{11}AgN_2O_2$, 3228⁸.
 $C_8H_{11}CnN_2O_2$, 2175⁸.
 $C_8H_{11}NO_2$ Valeric acid, α -(dimethylamino-methyl) γ -hydroxy-, lactone, methiodide, 3084¹.
 $C_8H_{11}LaN_2O_2$, 2175⁸.
 $C_8H_{11}N_2O$ Conhydrinone, methyl-, oxime, 1280⁸.
 $C_8H_{11}N_2O_2$ Malonamide, *N*, *N'*-diisopropyl-, 1696⁸.
 $C_8H_{11}N_2O_4$ Carbamic acid, methylenebis-, diisopropyl ester, 2478⁸.
 $C_8H_{11}N_2NdO_2$, 2175⁸.
 $C_8F_{11}N_2O_2Pr$, 2175⁸.
 $C_8H_{11}N_2O_2Yt$, 2175⁸.
 $C_8H_{11}O$ Cyclohexanethanol, 3-methyl-, 2030⁸.
 Cyclohexanepropanol, 2040⁸.
 Δ^1 -2-Heptenol, 2-ethyl-, 1852⁸.
 Isovalerone, 2771⁸.
 2-Nonanone, 2807⁸.
 3-Octanone, 1-methyl-, 2474⁴.
 $C_8H_{11}O_2$ Caproic acid, methyl-, Et ester, 4641⁸.
 Cyclohexanol, 2-ethoxy-4(or 5)-methyl-, 2644⁷.
 2-Furancarbinol, α -butyltetrahydro-, 1564¹.
 1-Hexanol, methyl-, acetate, 463⁸, 464².
 Isocaproic acid, propyl ester, 2214¹.
 Pelargonaldehyde, θ -hydroxy-, 468⁸.
 Pelargonic acid, 1695², 3251⁸.
 $C_8H_{11}O_2$ Butyric acid, *sec*-butyloxymethyl ester, 2930⁸.
 2-Furaldehyde, tetrahydro-, di-Et acetal, 2781⁸.
 $C_8H_{11}O_2$ Propionic acid, β , β -diethoxy-, Et ester, 2324⁸.
 $C_8H_{11}O_2$ Arabinoside, methyltrimethyl-, 1409⁸.
 $C_8H_{11}O_2$ *d*-Glucose, trimethyl-, 2813⁸.
 $C_8H_{11}IS$ Allyldipropylsulfonium iodide, 1408⁸.
 $C_8H_{11}N$ Cyclohexylamine, 2-isopropyl-, 1862⁸.
 —, 2-propyl-, and salts, 1862⁸.
 Piperidine, 1-*sec*-butyl-, 288⁸.
 $C_8H_{11}NO$ Conhydrine, methyl-, 1280⁸.
 $C_8H_{11}NO_2$ Carbaric acid, butoxyethyl-, Et ester, 2186⁸.
 —, butylethoxy-, Et ester, 2186⁸.
 $C_8H_{11}N_2$ Conhydrinone, methyl-, hydrazone, 1280⁸.
 $C_8H_{11}N_2O$ Heptanone, methyl-, semicarbazone, 239⁸, 2474⁴.
 $C_8H_{11}N_2O_2$ 3-Hexanone, 4-ethyl-4-hydroxy-, semicarbazone, 822⁸.
 C_8H_{11} Pentane, 3,3-diethyl-, 2633⁸.
 $C_8H_{11}IS_3$ Ethyldipropylsulfonium iodide, CH_3 addn. compd., 1403⁸.
 $C_8H_{11}P_3S$ Triethylphosphonium sulfide, methiodide, CH_3 addn. compd., 1403⁸.
 $C_8H_{11}O_2$ 3-Heptanol, 2,6-dimethyl-, 2474⁴.
 Octanol, methyl-, 2474⁴.
 $C_8H_{11}O_2$ Heptanediol, 3-methyl-, 352⁸, 1852⁸.
 3,4-Hexanediol, 3-ethyl-5-methyl-, 352⁸.

- Nonanediol, 1564¹.
 Propionaldehyde, diisopropylacetal, 1694⁴.
 C₂H₃O₂ Butyric acid, α -benzoyl- γ -phenyl-, Et ester, 1269⁷.
 C₂H₃O₂ Oxalocarbonic acid, tetra-Et ester, 237².
 C₂H₃BrN₃ s-Triazine, 1,3,5-triethylhexahydro-, dibromide, 538⁹.
 C₂H₃Br₂P Phosphine triethyl-, 1,3-dibromo-propane addn. compd., 2323⁸.
 C₂H₃CoN₂O₂, 2175⁹.
 C₂H₃I₄N Tetraethylammonium iodide, CHI₃ addn. compd., 1402⁹.
 C₂H₃LaN₂O₂, 2175⁹.
 C₂H₃N₃ s-Triazine, 1,3,5-triethylhexahydro-HCl, 538⁹.
 C₂H₃N₃O Semicarbazide, 1,2-diisobutyl-, 3478⁴.
 C₂H₃N₃NaO₂, 2175⁹.
 C₂H₃N₃O₂Pr, 2175⁹.
 C₂H₃I₂NO₂ Diethyl[β - (β - hydroxyethoxy)-ethyl]methylammonium iodide, P 560⁹.
 C₂H₃IP Triethylpropylphosphonium iodide, 1403⁹.
 C₂H₃I₂N₂O 2 - Propanol, 1,3 - bis(dimethyl-amino)-, dimethiodide, P 1757⁷.
 C₂H₃Sn₂ Distannane, 1-triethyl-2-trimethyl-, 2929¹.
 C₂H₃Br₂O₂Sn₂ Compd. from Me₃SnOH and Me₃SnBr, 2929¹.
 C₂H₃Cl₂O₂Sn₂ Compd. from Me₃SnOH and Me₃SnCl, 2929¹.
 C₂H₃I₂O₂Sn₂ Compd. from Me₃SnOH and Me₃SnI, 2929¹.
 C₂H₃Mg₂O₂, 2902⁴.
 C₂N₂Na₃ + 5H₂O Sodium hydromelionate, 3228¹.
 C₂H₃BrO₂ Pyromellitic anhydride, 3-bromo-, 1275⁴.
 C₂H₃O₂ Pyromellitic anhydride, 1275⁴.
 C₂H₃N₂O₂ Pyromellitimide, 1273⁹.
 C₂H₃Br₂N₂O Naphthalene, bromodinitro-, 827⁴, 3486⁹.
 C₂H₃Br₂O₂ Pyromellitic acid, 3-bromo-, 1275⁴.
 C₂H₃Br₂O 2(1)-Naphthalenone, 1,1,6-tribromo-, 59⁴.
 C₂H₃Cl₂INO₂, Cinchoninic acid, 2-chloro-6-iodo-, 506⁹.
 Cinchoninyl chloride, 2-hydroxy-6-iodo-, 506⁹.
 C₂H₃Cl₂N₂O Naphthalene, 1-chloro-2,4-dinitro-, 827⁴.
 C₂H₃N₂O₂ Naphthoquinone, anthranilo-, 644⁹.
 C₂H₃N₂O₂ 4-Naphthoquinone, 2-nitro-, 2200⁴.
 C₂H₃N₂O Naphthalene, 1,2,4-trinitro-, 827⁴.
 C₂H₃Br₂N₂O Naphthalene, bromonitro-, 827⁴, 3486⁹.
 C₂H₃Br₂O 2(1)-Naphthalenone, 1,1-dibromo-, 59⁴.
 C₂H₃Cl₂NO 2-Indoleglyoxylyl chloride, 280⁹.
 Naphthalene, 2-chloro-1-nitro-, 827⁴.
 C₂H₃Cl₂O 1-Naphthol, 2,4-dichloro-, 827⁴.
 C₂H₃INO₂ Cinchoninic acid, 2-hydroxy-6-iodo-, 506⁹.
 C₂H₃N₂O 2-Diazonaphthalene 1-oxide, 827⁴.
 C₂H₃N₂O 2-Indolecarboxylic acid, 6-cyano-, 506⁹.
 Pyrocolls, 1200⁹.
 C₂H₃N₂O Naphthalene, dinitro-, 827⁴, 2601¹.
 C₂H₃N₂O Cinchoninic acid, 2-hydroxy-6-nitro-, 68⁹.
 C₂H₃N₂O Naphthoquinone, 873⁴, 3288¹.
 C₂H₃O₂ Naphthosulfonethiosulfonic acid, and K salt, 514¹.
 C₂H₃O₂ Pyromellitic acid, 62⁴.
- C₂H₃BrMg 1-Naphthylmagnesium bromide, 1704⁴.
 C₂H₃Br₂N₂O 1-Naphthylamine, 4-bromo-3-nitro-, 2201¹.
 C₂H₃Br₂N₂O Barbituric acid, bromophenyl-, 1560⁹.
 C₂H₃Br₂O Naphthol, bromo-, 495⁴, 987⁴.
 C₂H₃Br₂O Acrylic acid, β -benzoyl- α -bromo-, 982⁹.
 Umbelliferone, 3-bromo-4-methyl-, 2665⁹.
 C₂H₃Br₂N₂O* 1,2,3-Triazole-4-carboxylic acid, 1-(2,4-dibromophenyl)-5-methyl-, 476⁹.
 C₂H₃Cl₂N₂O 1-Naphthylamine, 4-chloro-3-nitro-, 2201¹.
 C₂H₃Cl₂N₂O 2-Lepidinol, 3-chloro-5(?) -nitro-, 43⁷.
 C₂H₃ClO₂S 1-Naphthalenesulfonic acid, 5-chloro-, salts, 2489⁹.
 C₂H₃Cl₂N Naphthylamine, dichloro-, P 300⁹.
 C₂H₃Cl₂N₂O* 4,5-Pyrazolone, 1-(2,4-dichlorophenyl)-3-methyl-, 4-oxime, 508⁴.
 1,2,3-Triazole-4-carboxylic acid, 1-(dichlorophenyl)-5-methyl-, 476⁹.
 C₂H₃IO₂S 2-Naphthalenesulfonyl iodide, 3250⁹.
 C₂H₃NO Cinnamyl cyanide, 2946⁹.
 C₂H₃NO Naphthalene, 1-nitro-, 2660⁹, P 2673¹.
 C₂H₃NO Indoleglyoxylic acid, 279⁹, and Ag salt, 280⁴.
 Kynurenic acid, 1731⁴.
 Pseudoisatin, acetyl deriv., 1664¹.
 C₂H₃INO Cinnamic acid, α -cyano-2,4-dihydroxy-, 485⁷.
 2,6-Indodicarboxylic acid, 506⁹.
 1,3,2,4-Isouquinolinedione, 6,7-methylenedioxy-, 2663¹.
 Piperonylic acid, 6-(cyanomethyl)-, 2663¹.
 C₂H₃NO₂ Acrylic acid, β -m-nitrobenzoyl-, 983⁹.
 C₂H₃N₂ Malononitrile, benzalamino-, 2810⁹.
 C₂H₃N₂O Benzamide, N-dicyanomethyl-, and -HCl, 2810⁹.
 Malononitrile, salicylamino-, 2810⁹.
 C₂H₃N₂O 4-Imidazolecarboxylic acid, 2-nitrophenyl-, and sulfate, 987⁴.
 Pseudoisatin, 5-(α -isouromucetamido)-, 65⁴.
 1,2,5-Triazole-3-carboxylic acid, 4-(α -carboxyphenyl)-, and Ba salt, 2205⁷.
 C₂H₃N₂O* 1,2,5-Triazole-3,4-dicarboxylic acid, 1- β -sulfophenyl-, and Na salt, 2205⁷, 2206⁹.
 C₂H₃ See Naphthalene.
 C₂H₃Br₂NO₂ 1,3,4-Thiadiazole-2-mercaptan, 4-acetyl-5-(α -bromophenylimino)-4,5-dihydro-, 988⁹.
 C₂H₃Br₂O Coumarin, 6-methyl-, dibromide, 3267⁹.
 C₂H₃Br₂O Propionic acid, β -benzoyl α , β -di-bromo-, 982⁹.
 C₂H₃Br₂O Hydrocinnamic acid, tetrabromo- β -methoxy-, 3268⁹.
 C₂H₃Cl₂ Quinaldine, 4-chloro-, 1279⁴.
 Quinoline, 3-chloro-6-methyl-, 830⁹.
 C₂H₃Cl₂NO 2,4-Lepidinol, 3-chloro-, 43⁷.
 C₂H₃Cl₂O 4,5-Pyrazolone, 1-(α and β -chlorophenyl)-3-methyl-, 4-oxime, 507⁴, 508¹.
 C₂H₃Cl₂N₂O 5-Pyrazolone, 1-(2,4-dichlorophenyl)-3-methyl-, and -HCl, 508⁴.
 C₂H₃Cl₂NO Acetoacetanilide, α , α , β -trichloro-, 43⁷.
 C₂H₃Cl₂ Quinaldine, 6-iodo-, 506⁹.
 C₂H₃N₂ 3-Isocyanitrile, 2-methyl-, 279⁹, 505¹.

- $C_{10}H_8N_2O$ Cinchoninamide, 2954².
4-Pyridinol, 6-phenyl-, 1573⁹.
 $C_{10}H_8N_2O_2$ 4-Imidazolecarboxylic acid, 2-phenyl-, -HNO₃, 987⁷.
 $C_{10}H_8N_2O_3$ 3-Indoleglyoxylic acid, oxime, 279⁷.
 $C_{10}H_8N_2O_4$ Fural, dioxime, 1548⁴.
Hydrocinnammonitrile, 4,5-methylenedioxy-2-nitro-, 2652².
 $C_{10}H_8N_2O_5$ Isophthalic acid, 4,6-dicarbamyl-(?), di-Na salt, 1274¹.
Phthalic acid, 4,5-dicarbamyl-(?), di-Na salt, 1274¹.
Pterephthalic acid, 2,5-dicarbamyl-(?), di-Na salt, 1274¹.
 $C_{10}H_8N_2O_6$ Pyrocatechol, 3,5-dinitro-, diacetate, 644².
 $C_{10}H_8N_2O_7$ 3-Furazanaldehyde, 4-(phenylimino-methyl)-, 5-oxide, oxime, and isomer, 2807⁹.
 $C_{10}H_8N_2O_8$ Picrotonic acid, 2049⁷.
 $C_{10}H_8N_2O_9$ Compd., m. 143°, from metacyanilic acid and diazobenzene, 2808⁹.
 $C_{10}H_8O$ See *Naphthol*.
 $C_{10}H_8OS$ Coumarin, 6 methylthio-, 3265⁹.
 $C_{10}H_8O_2$ β -Butenic acid, γ -hydroxy β -phenyl-, lactone, 63².
Coumarin, 6 methyl-, and salts, 3265⁹.
2,7 Naphthalenediol, 828⁴.
 $C_{10}H_8O_3$ Acrylic acid, β benzoyl-, 63², 982⁸.
1,2-Benzofurandione, 3,5-dimethyl-, 2046⁸.
1-Indanecarboxylic acid, 3 keto-, 494².
 $C_{10}H_8O_4S$ See *Naphthalenesulfonic acid*.
 $C_{10}H_8O_5$ Acrylic acid, β - p -hydroxybenzoyl-, 983¹.
Chromone, 3,7-dihydroxy 2 methyl-, 517³.
Cinnamic acid, 3,4-methylenedioxy-, 2475⁸.
Pyromelic acid, 2 furancarbinol ester, 1705².
 $C_{10}H_8O_6S$ 2 Naphthol-6 sulfonic acid, salts, 2182⁹.
 $C_{10}H_8O_7$ Coumarin, 5,7 dihydroxy-3 methoxy-, 651⁴.
 $C_{10}H_8O_8S$ Naphthalenethiosulfonic acid, dihydroxy-, K salt, 514¹.
 $C_{10}H_8O_9$ Phthalic acid, 4 (carboxymethyl)-, 1271¹.
 $C_{10}H_8O_9S$ 2 Naphtholdisulfonic acid, Na salt, 1907².
 $C_{10}H_8AgClNO_2$ Carbamic acid, hydroxy-, Et ester, p -chlorobenzoate, Ag salt, 970¹.
 $C_{10}H_8AgN_2O$ Carbamic acid, hydroxy-, Et ester, mixed p -nitrobenzoate, Ag salt, 970¹.
 $C_{10}H_8AsCl_2$ Argine, bis(β -chlorovinyl)phenyl-, and AgN(b) addn. compd., 2323⁷.
 $C_{10}H_8BF_2O$ 1,8 Butanedione, 1-phenyl-, compd. with BF₃, 229⁹.
 $C_{10}H_8BrN$ Imidazole, 5-bromo-1-methyl-4-phenyl-, 1706².
Pyrazole, 4-bromo-1-methyl-3 (and 5) phenyl-, 2049⁹.
 $C_{10}H_8BrO_2$ Δ^2 2 Butenone, 4-5 bromosalicyl-, 484⁷.
Cinnamic acid, bromo-, Me ester, 3263⁷.
 $C_{10}H_8BrO_3$ Cinnamic acid, α and β -bromo- p -methoxy-, 3264⁷.
 $C_{10}H_8BrO_4$ m -Mecouin, 6-bromo-, 2939⁹.
 $C_{10}H_8BrO_5S$ Anisic acid, 5-bromo-2-(carboxymethyl)mercaptol-, 2338⁹.
 $C_{10}H_8Br_2O_3$ Hydrocinnamic acid, α, α, β -tri-bromo- p -methoxy-, 3284².
 $C_{10}H_8ClN_2$ Pyrazole, 5-chloro-4-methyl-3-phenyl-, 2953¹.
 $C_{10}H_8ClN_2O$ 5-Pyrazolone, 1-(chlorophenyl)-3-methyl-, and -HCl, 807⁹, 508¹.
 $C_{10}H_9ClO_2$ Lactyl chloride, benzoate, 466⁸.
 $C_{10}H_9Cl_2NO_2$ Acetoacetanilide, α, α -dichloro-, 43².
 $C_{10}H_9Cl_3NO_2$ Aniline, acid trichloroacetate, 1557⁷.
 $C_{10}H_9N$ (See also *Naphthylamine*).
Quinaldine, 1572⁸.
 $C_{10}H_9NO$ Carbostryl, 4-methyl-, 1278⁹.
3-Indolealdehyde, 5-methyl-, 830².
Quinoline, 7-methoxy-, 293².
4-Quinolol, 2-methyl-, 1279¹.
 $C_{10}H_9NO_2$ Hydrocinnammonitrile, 3,4-methylene-dioxy-, 2652².
2-Indolecarboxylic acid, 5-methyl-, and NH₄ salt, 830².
 α -Tolunitrile, α -hydroxy-, acetate, 2815⁷.
 $C_{10}H_9NO_3$ 5-Benzofuranol, 2-amino-1,2-dihydro-, acetate, 1421⁴.
 m -Hydrocoumaric acid, α -cyano-, 485².
Melilotic acid, α -cyano-, 485².
 Δ^2 -Oxazoline-4-carboxylic acid, 2-phenyl-, 638².
 Δ^2 2-Oxazolinol, benzoate, 2052³.
 $C_{10}H_9NO_4S$ Naphthionic acid, Na salt, 3395⁹.
 $C_{10}H_9NO_5$ Glycine, N -piperonylidene-, salts, 243⁷.
Hydrocinnamic acid, α -cyano-, 2,4-dihydroxy-, 485².
 $C_{10}H_9NO_6$ Homophthalamic acid, 4,5-methylene-dioxy-, 2663¹.
 $C_{10}H_9NO_7$ Hydrocinnamic acid, 4,5-methylene-dioxy-2-nitro-, 2652².
 m -Mecouin, 6-nitro-, 2939⁹.
 $C_{10}H_9NO_8S$ Naphthalenedisulfonic acid, amino-, Na salt, 1907².
 $C_{10}H_9NS$ Thiazole, 2 methyl 5-phenyl-, and chloroplatinate, 1706².
 $C_{10}H_9N_2O_2$ Tetrolaldehyde, p -nitrophenylhydraz-one, 2953⁸.
 $C_{10}H_9N_2S$ 1,1,3-Isotiothiadiazine-2-carbamic acid, 5-phenylidithio-, 832².
 $C_{10}H_9N_2O_3$ 3,4-Furazandialdehyde, 2-oxide, 3-phenylhydrazone, 4 oxime, 2807⁹.
 $C_{10}H_9N_2O_4$ Glycine, N -(aminocyanamino-methylene)-(?), picrate, 2052³.
5-Oxazolidone, 2-amino-2-cyanamino-(?), picrate, 2052³.
 $C_{10}H_9Na_2O_4$ Glyoxylic acid, (6-hydroxy-2,4-xylyl)-, Na deriv., Na salt, 2046⁸.
 $C_{10}H_9$ Naphthalene, dihydro-, 2032², 2870⁹.
 $C_{10}H_9AgClNO_4$, 1526⁴.
 $C_{10}H_9BeCl_2N_2$, 3071⁴.
 $C_{10}H_9BrNO_2$ Anisic acid, 2-acetamid-5-bromo-, 2348⁷.
 $C_{10}H_9BrN_2O_3$ Pyruvyl bromide, 3-nitro- p -tolyl-hydrazon-, 3090⁹.
 $C_{10}H_9Br_2N_2O$ Pyruvyl bromide, 3-bromo- p -tolylhydrazon-, 3090⁹.
 $C_{10}H_9Br_2N_2O_2$ Malonamide, α -bromo- N -(p -bromophenyl)- N' -methyl-, 1696⁷.
 $C_{10}H_9Br_2O_3$ Hydrocinnamic acid, α, β -dibromo- p -methoxy-, 3264².
 $C_{10}H_9ClHgNO_2$ Acetanilide, 2-acetoxymercuri-4-chloro-, 50².
 $C_{10}H_9ClNO_2$ Acetoacetanilide, α -chloro-, 43².
 $C_{10}H_9ClNO_3$ Carbanilic acid, p -chloroformyl-, Et ester, 979¹.
 $C_{10}H_9ClNO_4$ Carbamic acid, hydroxy-, Et ester, p -chlorobenzoate, 970¹.
Tyrosine, chloro-, formyl deriv., 2817².
 $C_{10}H_9Cl_2N_2O$ Pyruvyl chloride, 3-nitro- p -tolyl-hydrazon-, 3090⁹.
 $C_{10}H_9Cl_2NO_2$ Oxazolidine, 5-chloromethyl 2-imino-, picrate, 2052³.

- C₁₀H₉ClN₂O₂ Acetophenone, 5-chloro-3-ethyl-2-hydroxy-, Na deriv., 271¹.
- C₁₀H₉ClN₂O₂ 1,386².
- C₁₀H₈N₂ 4,4'-Bipyridine, dihydro-, 518¹.
2,7-Naphthylenediamine, 498¹.
α-Nicotyrine, 74¹.
Pyrazole, methylphenyl-, 2049¹.
- C₁₀H₇N₂O Pyrazole, 5-methoxy-3-phenyl-, 2955¹.
Pyrazolone, methylphenyl-, 2952¹.
- C₁₀H₇N₂O₂ 2-Indazolecarboxylic acid, 5-methyl-, Me ester, 512¹.
5(4)-Isoxazolone, 3-toluino-, 471¹.
1,5,2 - Pyridopyrimidine - 2,4(3) - dione, 3-ethyl-, 70¹.
- C₁₀H₇N₂O₂S Hydantoin, 5-*p*-anisyl-2-thio-, 637¹.
C₁₀H₇N₂O₂S 5(4)-Isoxazolone, 3-methoxyanilino-, 471¹.
- C₁₀H₇N₂O₂S Glutamic acid, cycloglutamyl-, 638¹.
C₁₀H₇N₂O₂S Benzenesulfonic acid, *p*-(4,5-dihydro-5-keto-3-methyl-1-pyrazolyl)-, 2050¹.
- C₁₀H₇N₂O₂S Carbaric acid, hydroxy-, Et ester, *m*(and *p*)-nitrobenzoate, 970¹.
Dipicolinic acid, 4-carboxyamino-, 4-ethyl ester, 70¹.
- C₁₀H₇N₂S 2-Imidazolemercaptan, 4-methyl-1-phenyl-, 1710¹.
- C₁₀H₇N₂O₂S 1,3,4,6-Thiodiazin-5(4)-one, 2-(benzylhydrazono)-2,3-dihydro-, 2206¹.
- C₁₀H₇N₂O₂ Uracil, 5-phenylhydrazino-, 2055¹.
- C₁₀H₇N₂O₂ Glyoxylamide, *N,N'*-*p*-phenylene-bis-, dioxime, 65¹.
- C₁₀H₇N₂O₂ Benzaldehyde, 2,6-dinitro-, carbethoxyhydrazono-, 3092¹.
- C₁₀H₇N₂O₂ Creatinine, picrate, 1853¹, 3255¹.
- C₁₀H₇N₂O Δ²-2-Butenone, 4-phenyl-, 2329¹, 3175¹.
3-Butin-2-ol, 2-phenyl-, 463¹.
Naphthalene, 1,2-epoxy-1,2,3,4-tetrahydro-, 2644¹.
1(2)-Naphthalenone, 3,4-dihydro-, 2201¹.
- C₁₀H₇N₂O₂ 2(1)-Benzofuranone, 3,5-dimethyl-, 2046¹.
Δ²-2-Butenone, 4-salicyl-, 484¹.
4-Chromanone, methyl-, 517¹.
Cinnamic acid, Me ester, 1401¹, 3263¹.
—, *p*-methyl-, 2475¹.
Isosafrole, 646¹.
Safrole, 646¹.
- C₁₀H₇N₂O₂ Acrylophenone, β-hydroxy-α-methoxy-, 2342¹.
Cinnamic acid, *p*-methoxy-, 2475¹.
Cinnamic alcohol, 3,4-methylenedioxy-, 266¹.
Cubebin, 266¹.
Propionic acid, β-benzoyl-, 64¹.
Terephthalaldehydic acid, 3,5-dimethyl-, 483¹.
- C₁₀H₇N₂O₂ Benzaldehyde, *m*-hydroxy-, acid carbonate, Et ester, 2331¹.
2(1)-Benzofuranone, 3,5-dimethoxy-, 483¹.
Benzoic acid, *m*-hydroxy-, Me ester, acetate, 1417¹.
2,4-Cresotic acid, acetate, P 1179¹.
Feric acid, 2615¹.
Formic acid, (*p*-formylphenoxy)-, Et ester, 76¹.
Isophthalic acid, di-Me ester, SnCl₄ addn. compd., 51¹.
Meconin, 1134¹, 2999¹.
Phthalic acid, di-Me ester, SnBr₄ addn. compd., 51¹.
Terephthalic acid, di-Me esters, SnCl₄ addn. compd., 51¹.
p-Toluic acid, α-hydroxy-, acetate, 2815¹.
- C₁₀H₇N₂O₂ (See also *Optianic acid*.)
- Anisic acid, 2-hydroxy-, acetate, 3566¹.
C₁₀H₇N₂O₂ Hemipic acid, 1134¹.
- C₁₀H₇N₂O₂ Propionic acid, β-benzoyl-α-sulfo-, 983¹.
- C₁₀H₇N₂O₂ Isophthalic acid, 2,4,6-trihydroxy-, di-Me ester, 646¹.
- C₁₀H₇BrN₂O Pyruvyl bromide, 3-nitro-*p*-tolylhydrazono-, 3090¹.
- C₁₀H₇BrN₂O₂ Malonamide, α-bromo-*N*-*p*-tolyl-, 1697¹.
Urea, α-(α-bromopropionyl)-β-phenyl-, 237¹.
- C₁₀H₇BrN₂O₂ Pyruvyl bromide, 3-nitro-*p*-tolylhydrazono-, oxime, 3090¹.
- C₁₀H₇BrO₂ Acetophenone, α-bromo-2-hydroxy-4,6-dimethoxy-, 1260¹.
- C₁₀H₇BrCl Toluene, *o*(and *p*)-(β,γ-dibromop-γ-chloropropyl)-, 2645¹.
- C₁₀H₇BrN 2-Naphthylamine, dibromotetrahydro-, 497¹.
- C₁₀H₇BrN₂O 2-Naphthol, 7-amino-1,3-dibromo-5,6,7,8-tetrahydro-, and -HBr, 497¹.
- C₁₀H₇Cl Toluene, *o*(and *p*)-γ-chloroallyl-, 2645¹.
- C₁₀H₇ClN₂O Crotonanilide, β-amino-α-chloro-, 43¹.
Pyruvyl chloride, *p*-tolylhydrazono-, 3090¹.
- C₁₀H₇ClN₂O₂ *p*-Cymene, 6-chloro-2,3-dinitro-, 42¹.
- C₁₀H₇ClO Anisole, *p*-γ-chloroallyl-, 2645¹.
Ethylene oxide, α-(α-chloroethyl)-β-phenyl-, 2411¹.
- Hydrotropyl chloride, *p*-methyl-, 277¹.
- C₁₀H₇ClO₂ Acetophenone, 5-chloro-3-ethyl-2-hydroxy-, 271¹.
—, 3-chloro-6-hydroxy-2,4-dimethyl-, 2339¹.
Phenol, 4-chloro-2-ethyl-, acetate, 271¹.
- C₁₀H₇ClN₂O Isobutyranilide, β,β-dichloro-α-hydroxy-, 264¹.
- C₁₀H₇ClO 1-Butanol, 2,2,3-trichloro-1-phenyl-, 2411¹.
- C₁₀H₇N₂O Isoindazole, 1-acetyl-, methiodide, 509¹.
- C₁₀H₇N Indole, dimethyl-, 511¹, 1862¹, 2493¹.
—, ethyl-, 1277¹, 1862¹.
2-Naphthylamine, *α*-dihydro-, 497¹.
Quinaldine, 1,2-dihydro-, 2343¹.
- C₁₀H₇N₂O Crotonophenone, β-amino-, 245¹.
Indole, methoxymethyl-, 2048¹.
Methylquolinolium hydroxide, 2705¹.
2-Pyrrolidone, 1-phenyl-, 2664¹.
- C₁₀H₇N₂O₂ α-Alanine, *N*-benzal-, *Ns* salt, 243¹.
4-Chromanone, methyl-, oxime, 517¹.
Crotonamide, α-hydroxy-γ-phenyl-, 2265¹.
- C₁₀H₇N₂O₂ Malonanilic acid, *m*-methyl-β-thio-, 471¹.
- C₁₀H₇N₂O₂ Acetic acid, phenyl-, 83¹.
Alanine, benzoyl-, 83¹.
Cresotamide, acetate, 1416¹.
—, *N*-acetyl-, 1416¹.
- C₁₀H₇N₂O₂ Malonic acid, α-benzyl-, 485¹.
- C₁₀H₇N₂O₂ Malonanilic acid, *p*-methoxy-β-thio-, 471¹.
- C₁₀H₇N₂O₂ Acetohydroxamic acid, methoxy-, benzoate, and salts, 240¹.
Benzoic acid, lactamide ester, 244¹.
Carbamic acid, hydroxy-, Et ester, benzoate, 969¹.
Carbanilic acid, *p*-carboxy-, Et ester, 979¹.
m-Meconin, 6-amino-, 2939¹.
Nicotinic acid, 5-acetyl-1,6-dihydro-6-keto-1,2-dimethyl-, 2497¹.
Serine, benzoate, and -HCl, 338¹.
Tyrosine, formyl-, 126¹.

- C₁₀H₁₁NO₂** Anisaldehyde, 2-ethoxy-5-nitro-, 1701².
C₁₀H₁₁NO₂ Oxalic acid, aniline salt, 2034¹.
C₁₀H₁₁N₃ Naphthalenetriamine, *derivs.*, 2661², 2662¹.
 1, 2, 3-Triazole, 4-ethyl-1-phenyl-, 2341².
C₁₀H₁₁N₃O 5-Pyrazolone, 3-*m*(and *o*)-toluino-, 471².
C₁₀H₁₁N₃O₂ 5-Pyrazolon², 3-methoxyanilino-, 471².
C₁₀H₁₁N₂O₂ 2(1)-Benzofuranone, 5-methoxy-, semicarbazone, 1421².
C₁₀H₁₁N₂O₂ 2-Naphthol, 7-amino-5, 6, 7, 8-tetrahydrodinitro-, and *salts*, 497².
C₁₀H₁₁N₂S 1, 4, 3-Isotiadiazine, 2-methylamino-5-phenyl-, -*HI*, 831².
C₁₀H₁₁N₂S₂ 1, 3, 4-Thiadiazole, 2, 3-dihydro-5-methylmercapto-2-*p*-tolylimino-, 988².
 1, 3, 4-Thiadiazole-2-mercaptan, 4, 5-dihydro-5-xylylimino-, 988².
C₁₀H₁₁N₂O₇ Δ²-Pyrazoline, methyl-, picrate, 284¹.
C₁₀H₁₂ (See also *Tetralin*.)
 Benzene, butenyl-, 977², 1261¹.
C₁₀H₁₂AsNO₂ Carbanilic acid, 5-arsono-2-(carboxyoxo)-, di-Me ester, 979².
C₁₀H₁₂BrClO₂S Camphor-*ω*-sulfoxide, α-bromo-*γ*-chloro-, 1137².
C₁₀H₁₂BrIN 3-Bromo-1, 2, 5-trimethyl-2-isoin-dazolium iodide, 512².
C₁₀H₁₂BrNO₂ *m*-Acetanilide, 4-bromo-6-methyl-, 2338².
 Cuminic acid, 2-amino-5-bromo-, -*HCl*, 641².
C₁₀H₁₂Br₂ *p*-Cymene, 2, 5-dibromo-, 641².
C₁₀H₁₂ClNO₂ 2, 4-Acetoxydide, 6-chloro-, 2341².
 Butyraniide, *γ*-chloro-, 2664².
C₁₀H₁₂ClNO₂ Acetophenetide, chloro-, 642².
 Acetophenone, 3-chloro-6-hydroxy-2, 4-dimethyl-, oxime, 2339².
 Anethole, nitrosochloride, 2648².
C₁₀H₁₂ClN₂ 1, 2, 3-Benzotriazole, 5(or 6)-chloro-7(or 4)-isopropyl-4(or 7)-methyl-, 42².
C₁₀H₁₂Cl₂O 1-Butanol, 2, 3-dichloro-1-phenyl-, 241².
C₁₀H₁₂HgOS Xanthic acid, benzyl mercuric deriv., and *p*-tolylmercuric deriv., 465².
C₁₀H₁₂INS Benzothiazole, 1-methyl-, ethiodide, 2339².
C₁₀H₁₂N₂ Indazole, 2-ethyl-5-methyl-, 511².
 —, 2-propyl-, 3091².
 Isoindazole, 1-ethyl-5-methyl-, 511².
 Δ²-Pyrazoline, 5-methyl-3-phenyl-, 283².
C₁₀H₁₂N₂O Crotonanilide, β-amino-, 245².
C₁₀H₁₂N₂O₂ Acetanilide, α-acetamido-, 470².
 Benzamide, *N*-(α-carbamylethyl)-, 244².
 Cyclohexanecetic acid, α, 1-dicyano-, *salts*, 268².
 Isoindazole, 1-acetyl-, MeOH deriv., 509².
 Isoquinoline, 1, 2, 3, 4-tetrahydro-6-methoxy-2-nitroso-, 990².
 Malonamide, *N*-methyl-*N'*-phenyl-, 1696².
 Pyruvic acid, *p*-tolylhydrazine, 830¹.
 1, α - Spiro[cyclohexane - succinimide], β-cyano-, 269².
C₁₀H₁₂N₂O₂ Acetamide, *N* - methyl - *N* - nitro-benzyl-, 3261².
 Allophanic acid, *γ*-phenyl-, Et ester, 972².
 2(1)-Benzofuranone, 3, 5-dimethoxy-, hydrazone, 483².
 Glycine, *N*-(*N*-phenylglycyl)-*γ*, 3083².
 Hydantonic acid, β-methyl-β-phenyl-, 2811².
 Hydracrylamide, α-benzamido-, 1852².
 2 Naphthol, 7-amino-5, 6, 7, 8-tetrahydrodinitro-, and *salts*, 497².
 2-Propanone, 1, 3-dihydroxy-, benzoylhydrazone, 247².
C₁₀H₁₂N₂O₂S 2 - Benzimidazolemethanesulfonic acid, α-ethyl-, and *salts*, 37².
C₁₀H₁₂N₂O₂ Anisaldehyde, 2-ethoxy-5-nitro-, oxime, 1701².
C₁₀H₁₂N₂O₂S Ethanesulfonic acid, β-*β*-eto-α-methyl-β-(β-phenylcarbamido)-, and *X salt*, 237².
C₁₀H₁₂N₂S Thiazolidine, 2 - methylimino - 3-phenyl-, 2481².
 —, 3-methyl-2-phenylimino-, 2481².
C₁₀H₁₂N₂O₂ 2 - Propanonol, 1-(*o*-nitrophenyl)-, semicarbazone, 2938².
 Pyruvamide, 3-nitro-*p*-tolylhydrazine, 3090².
 Uric acid, 9-allyl-1, 3-dimethyl-, 2811².
C₁₀H₁₂N₂O₂ *o*-Veratraldehyde, nitro-, semicarbazone, 482².
C₁₀H₁₂N₂O₂ Aniline, *N*, *N*-diethyltrinitro-, 978².
C₁₀H₁₂N₂O₂ Guanidine, α-acetyl-*γ*-methyl-, picrate, 1853².
C₁₀H₁₂O (See also *Anethole*.)
 Acetophenone, 3, 5-dimethyl-, 1405².
 Butyrophenone, 1899².
o-Cresol, 6-allyl-, 270².
 —, 6-propenyl-, 271².
 Cinnamaldehyde, 821².
 Estragole, 646².
 Propene oxide, 2-methyl-1-phenyl-, 231².
 α-Tolualdehyde, α, α-dimethyl-, 823².
C₁₀H₁₂O₂ (See also *Eugenol*; *Isoeugenol*.)
 Acetophenone, 2-hydroxy-3, 5-dimethyl-, 1405².
 —, methoxymethyl-, 1405².
 2-Butanone, 4-(*m*-hydroxyphenyl)-, 2044².
 Hydratropic acid, 4-methyl-, 277².
 Hydrocinnamic acid, α-methyl-, 3251².
 Naphthalenediol, tetrahydro-, 971², 1518².
 Propionic acid, *o*-tolyl ester, 271².
 Propiophenone, hydroxyethyl-, 271², 1405².
 Saffrole, dihydro-, 1152².
 Valeraldehyde, α-2-fural-, 1139¹.
C₁₀H₁₂O₂ Acetophenone, dimethoxy-, 2342².
 Agisaldehyde, ethoxy-, 1574², 1700².
 Benzofuran, 1, 2-dihydro-3, 5-dimethoxy-, 483².
 Mandelic acid, Et ester, 2484².
 Propionic acid, β-toloxo-, 517².
p-Toluic acid, α-hydroxy-, Et ester, 1417².
C₁₀H₁₂O₂S *p*-Toluenesulfonic acid, allyl ester, 977².
C₁₀H₁₂O (See also *Cantharidine*.)
 Acetic acid, 3-methyl-2-furoyl-, Et ester, 1139².
 Benzaldehyde, 3, 4, 5-trimethoxy-, 2651², 2652², 326².
 α-Toluidic acid, 3, 5-dimethoxy-, 2651².
C₁₀H₁₂O₂ Benzoic acid, 3, 4, 5-trimethoxy-, 2651².
 Butyric acid, dihydroxyphenoxy-, *Na salt*, 1907².
C₁₀H₁₂O₂S Lactic acid, *p*-toluenesulfonate, 1407².
C₁₀H₁₂O₂ Isodicyclopentadiene diazonide, 2459².
 Polydicyclopentadiene diazonide, 2459².
C₁₀H₁₂O₂ Iso-oxo-dicyclopentadiene diazonide, 2459².
C₁₀H₁₂S Sulfide, allyl *p*-tolyl-, 1562².
 —, propyl *p*-tolyl-, 1850².
C₁₀H₁₂As₂N₂O₂ *o*-Benzenedicarhamic acid, arsono-, di-Me ester, 979².
C₁₀H₁₂As₂P *p*-Thiarsane, 4-phenyl-, 1412².
C₁₀H₁₂Br Benzene, (β-bromobutyl)-, 1138².
C₁₀H₁₂BrClNO₂S Indanol, amino-, bromochloromethanesulfonate, 2927².

- C₁₀H₁₃BrN₂: Acetone, (*p*-bromophenyl)methylhydrazone, 45¹.
 2-Ethyl-1-methylindazolium bromide, 3091¹.
 C₁₀H₁₁BrN₂O Hydrazine, α -(*p*-bromophenyl)- β -isobutyl-, 1254¹.
 C₁₀H₁₁BrN₂O₂: See *Noclat*.
 C₁₀H₁₁BrO Benzene, (γ -bromo- β -methoxypropyl)-, 1261¹.
 C₁₀H₁₁BrO₂ Camphorquinone, β -bromo-, 1137¹.
 C₁₀H₁₁BrO₃ Citric acid, α -bromo-(?), lactone, di-Et ester, 470¹.
 Tricarballic acid, β -bromo- α -hydroxy-(?), lactone, di-Et ester, 470¹.
 C₁₀H₁₁Cl *p*-Cymene, 2-chloro-, 42¹.
 C₁₀H₁₁ClN₂: 2-Ethyl-1-methylindazolium chloride, 3091¹.
 Pyridine, chloro-(tetrahydro-1-methyl-2-pyrryl)-, 69¹.
 C₁₀H₁₁ClO Phenol, 4-chloro-2,6-diethyl-, 271¹.
 C₁₀H₁₁ClOS Ether, 4-chloroethyl β -phenylmercaptoethyl-, 1413¹.
 C₁₀H₁₁ClO₂ Ethes, β -chlorophenyl β -phenoxyethyl-, 1413¹.
 C₁₀H₁₁Cl₂NO Camphonanil chloride, 3-chloro-3-cyano-, 1418¹.
 C₁₀H₁₁IN₂: 2-Ethyl-1-methylindazolium iodide, 3091¹.
 C₁₀H₁₁N Aniline, *N*-isobutylidene-, 2645¹.
 Benzalimine, α -ethyl- α -methyl-, 2817¹.
 Compd., b_m 106-7°, from methyl-2-vinylpyridine and MeI, and salts, 1573¹.
 Indanamine, *N*-methyl-, 1520¹.
 Naphthylamine, tetrahydro-, 138¹.
 C₁₀H₁₁NO Acetanilide, *N*-ethyl-, 1270¹.
 Acetophenone, 3,5-dimethyl-, oxime, 1405¹.
 Butyrophenone, oxime, 982¹.
 Cyclohexanenitrile, 1-allyl-2-keto-, 1262¹.
 Hydratropamide, *p*-methyl-, 277¹.
 Isoquinoline, 1,2,3,4-tetrahydro 6-methoxy-, and salts, 989¹, 990¹.
 Morpholine, 4-phenyl-, 2207¹.
 2-Naphthol, 7-aminotetrahydro-, and HCl, 497¹.
 2-Propenone, 1-(*N*-methylanilino)-, 511¹.
 C₁₀H₁₁NO₂ *p*-Acetophenetide, thio-, 471¹.
 C₁₀H₁₁NO₂: See also *Phenacetin*.
 Acetophenone, 2-hydroxydimethyl-, oxime, 1404¹, 1405¹.
 —, methoxymethyl-, oxime, 1405¹.
 Benzoic acid, amino-, isopropyl and Pr esters, 2650¹.
o-Cresol, 4-nitroso-6-propyl-, 271¹.
 Δ^{17} -Cycloheptanecetic acid, α -cyano-, 268¹.
 Glycine, *N*-phenyl-, Et ester, 3083¹.
 Hydrocinnamamide, *m*-methoxy-, 990¹.
 1,3,4-Oxazin-5-ol, 2-phenyl-(?), 2041¹.
 1,3,4-Oxazin-5-one, 2-phenyl-(?), 2041¹.
 Propionamide, β -*p*-toloxy-, 517¹.
 Propiophenone, 2-hydroxy-5 β -methyl-, oxime, 1408¹.
 Propylamine, γ -(3,4-methylenedioxyphenyl)-, and salts, 2652¹.
 Valeraldehyde, α -2-fural, oxime, 1130¹.
 C₁₀H₁₁NO₃ Anisaldehyde, ethoxy-, oxime, 1574¹, 1701¹.
 Anisamide, 3-ethoxy-, 1574¹.
 2,6-Lutidine-3-carboxylic acid, 1,4-dihydro-4-keto-, Et ester, 472¹.
 3-Pyrrolecarboxylic acid, 2-formyl-4,5-dimethyl-, Et ester, 3270¹.
 C₁₀H₁₁NO₄: Serine, β -*p*-anisyl-, 76¹.
 C₁₀H₁₁NO₅: Lactamide, *p*-toluenesulfonamide, 1407¹.
 1-Propanesulfonic acid, 1-phenylcarbamyl-, and salts, 37¹, 38¹.
p-Toluenesulfonic acid, lactamide ester, 244¹.
 C₁₀H₁₁NO₆: Serine, β -(4-hydroxy-*m*-anisyl)-, 76¹.
 C₁₀H₁₁N₂O₅ Hydrazine, phenyl-, antimonyl tartrate, 1256¹.
 C₁₀H₁₁N₂O₆ Pyruvamide, *p*-tolylhydrazone, 3090¹.
 C₁₀H₁₁N₂O₇: Butyraldehyde, α -2-fural-, semicarbazone, 1139¹.
 C₁₀H₁₁N₂O₈ Hydrazine, α -isobutyl- β -(nitrophenyl)-, 1254¹.
 Semicarbazide, 4-(*m*-carboxyphenyl)-, Et ester, 1130¹.
 C₁₀H₁₁ (See also *Cymene*).
 Benzene, butyl-, 58¹, 977¹, 1890¹.
 —, diethyl-, 1222¹.
 Durene, 2870¹.
 C₁₀H₁₁AsNO₃ Carbanilic acid, arsono-, isopropyl and Pr esters, 979¹.
 —, 5-arsono-2-methyl-, Et ester, 979¹.
 C₁₀H₁₁BrClO₂S α -Camphorsulfonyl chloride, β -bromo-, 1137¹.
 C₁₀H₁₁BrCl₂NO₂S α -Camphorsulfonamide, 3-bromo *N,N*-dichloro-, 2043¹.
 C₁₀H₁₁BrN₂: Pyridine, aminobromo(tetrahydro-1-methyl-2-pyrryl)-, 69¹.
 C₁₀H₁₁Br₂O Camphor, dibromo-, 457¹, 2655¹.
 C₁₀H₁₁ClNO Camphonanil chloride, 3-cyano-, 1418¹.
 C₁₀H₁₁ClNO₂: Camphonanilic acid, 3-chloro-3-cyano-, 1419¹.
 C₁₀H₁₁ClN₂ (Zen, 1996¹).
 C₁₀H₁₁N₂ (See also *Nicotine*).
 Cycloheptanecarbonitrile, β -cyano-, 268¹.
 Naphthylendiamine, 1,2,3,4-tetrahydro-, and *di-HCl*, 498¹.
 Thymoquinonedimine, 981¹.
 C₁₀H₁₁N₂O Acetamide, α -anilino-*N*-ethyl-, 3083¹.
 Acetone, *p*-anisylhydrazone, 2048¹.
 Hydrazine, α -isobutyl β -phenyl-, 1254¹.
 Nicotinamide, *N,N*-diethyl-, 1601¹, 3114¹.
 2-Pyridol, 5-(tetrahydro-1-methyl-2-pyrryl)-, 69¹.
 C₁₀H₁₁N₂O₂ Urea, (β -hydroxyethyl)methylphenylthio-, 2481¹.
 C₁₀H₁₁N₂O₃ Isopilocarpidine, and salts, 2052¹, 2053¹.
 Pilocarpidine, 1709¹, and salts, 2052¹.
 Quinone, 2,5-bis(dimethylamino)-, 259¹.
 —, 2,5-bis(ethylamino)-, 259¹.
 Thymoquinone, dioxime, 981¹.
 C₁₀H₁₁N₂O₄ Barbituric acid, 5-allyl-5-isopropyl-, 2641¹, p 2864¹.
 —, 5-allyl-5-propyl-, 2641¹.
 Cyclohexanecarboxylic acid, 1-carbamyl- α -cyano-, and *N* salt, 268¹.
 Isobutyric acid, α,β -dihydroxy-, phenylhydrazide, 2180¹.
 3-Pyrrolecarboxylic acid, 2-formyl-4,5-dimethyl-, Et ester, oxime, 3270¹.
 1,4'-Spiro(cyclohexane-pyrrolidin)-3'-carboxamide, 2',5'-diketo-, 268¹.
 C₁₀H₁₁N₂O₅ *p*-Toluenesulfonamide, *N*-(α -carbamylethyl)-, 244¹.
 C₁₀H₁₁N₂O₆ Benzenesulfonamide, *N,N*-diethyl-*m*-nitro-, 642¹.
 C₁₀H₁₁N₂O₇: 2,5-Piperazinedione, 1,4-bis(hydroxymethyl)-, diacetate, 3255¹.
 C₁₀H₁₁N₂O₈ Acetone, 1-aminosemicarbazone, 482¹.
 C₁₀H₁₁N₂O₉ Semicarbazide, 2-isopropyl-1-nitroso-1-phenyl-, 642¹.

- C₁₀H₁₁N₂O₄ Pseudouric acid, 9-allyl-1,3-dimethyl-, 2811².
- C₁₀H₁₁N₂O₇P + H₂O Adenylic acid, salts, 473⁷.
- C₁₀H₁₁N₂O₈P Guanylic acid, 526⁹; salts, 473⁸.
- C₁₀H₁₁O (See also *Carvacrol*; *Carvone*; *Thymol*.)
- Benzyl alcohol, α -propyl-, 58⁷.
- , α ,3,5-trimethyl-, 1403⁹.
- 1-Butanol, 4-phenyl-, 1269².
- o-Cresol, 6-propyl-, 270⁴.
- p-Cymenol, 42⁷.
- Ether, benzyl isopropyl-, 2194¹.
- , benzyl propyl-, 2194⁴.
- Phenol, 2,6-diethyl-, 270⁴.
- Verbenone, 52⁷.
- C₁₀H₁₄O₂ (See also *Camphorquinone*.)
- Benzene, diethoxy-, 2648².
- Compd., m. 88-89°, from β decahydronaphthone dibromide, 487².
- Cyclohexanetetrollic acid, 3176⁹.
- 2-Furancarbinol, Valerate, 987².
- Ketone, isobutyl 3-methyl-2-furyl-, 1139².
- 1-Propanol, 3-toloxyl-, 517³.
- Verbanone, 2,3-epoxy-, 52⁷.
- C₁₀H₁₁O₂ Cineole, diketo-, 2651².
- Cyclohexanecetic acid, α acetyl 2-hydroxy-, lactone, 2644².
- (C₁₀H₁₁O)₂ Polydihydrodicyclopentadiene oxonide, 2659⁹.
- C₁₀H₁₁O₃ p-Toluenesulfonic acid, Pr ester, 977⁴, 1850⁹.
- C₁₀H₁₁O₄ Acid, m. 171°, from cyclodecanebis-cyclobutanedione and H₂O₂, 1409¹.
- 1-Norcanaric acid, 7-carboxy-, 2329².
- C₁₀H₁₁O₅ Acetonequinide, 2042².
- 1,2-Cyclohexanediacetic acid, 1,2-dihydroxy-, mono γ lactone, 2329².
- C₁₀H₁₁O₆ Acids, m. 1400 and 178°, from the γ lactone diethyl ester of 2-hydroxy-3,3-dimethyl-1,2,4-pentanetricarboxylic acid, 2329².
- C₁₀H₁₁O₇ Cellulose, diacid carbonate, di-Me ester, 251².
- C₁₀H₁₁BrO Camphor, bromo-, 487², 2655⁴.
- C₁₀H₁₁BrO₂ Δ^1 -Cyclohexanecetic acid, 2 bromo-, Et ester, 2329¹.
- C₁₀H₁₁BrO₃ Camphorsulfonic acid, bromo-, salts, 1137², 2943².
- C₁₀H₁₁Br₂NO₂ α Camphorsulfonamide, α , β -dibromo-, 1137².
- C₁₀H₁₁ClN₂ 2,3-p-Cymenediamine, 6 chloro-, 42⁷.
- C₁₀H₁₁ClO Camphor, chloro-, 487², 2655⁴.
- C₁₀H₁₁ClO₂ Camphorsulfonic acid, 3 chloro-, K salt, 2043²; NH₄ salt, 2943².
- C₁₀H₁₁ClO₃ Succinic acid, α acetyl chloro-, di Et ester, 2329².
- C₁₀H₁₁CuK₂O₈, 2608⁹.
- C₁₀H₁₁N Aniline, N-butyl-, 475¹, 2814⁴.
- , N,N-diethyl-, 1525², 1526², 2814⁴.
- Carvacramine, 641².
- 2,4-Xylidine, N,N-dimethyl-, 2192⁴.
- C₁₀H₁₁NO (See also *Ephedrine*; *Hordeanone*.)
- Cyclohexanenitrile, 2 keto 1 propyl-, 1262².
- Δ^1 -Cyclohexanenitrile, 2 propoxy-, 1262².
- Ethanol, 2-(2,5-dimethylamino)-, 2481¹.
- Phenol, m-diethylamino-, 2196².
- Pseudoephedrine, 1565¹, 2940¹.
- C₁₀H₁₁NO₂ Acetacetamide, β , β diallyl-, 376¹.
- sec-Camphene, α -nitro-, 1964².
- Camphoramic acid, 3-cyano-, 1419¹.
- Camphorimide, 269¹, 1418².
- Ethanol, β , β' -phenyliminobis-, salt, 2038¹.
- Indole, from the 3 monooxime of 3,4-pinanedione, m. 960, 53².
- 3,4-Pinanedione, 3-monooxime, 53².
- Pyrrrolecarboxylic acid, 5-ethyl-3-methyl-, Et ester, 1429².
- , trimethyl-, Et ester, 1420⁹.
- 3-Pyrrolopropionic acid, 2-ethyl-4-methyl-, 1429².
- Δ , α -Spiro[cycloheptane - succinimide], 268².
- C₁₀H₁₁NO₂S Benzenesulfonamide, N-isobutyl-, 3478⁹.
- β -Camphorsulfonamide, 2, N - inner anhydride, 2943².
- C₁₀H₁₁NO₃ 3-Pyrrololecarboxylic acid, (hydroxymethyl)dimethyl-, Et ester, 2336².
- C₁₀H₁₁NO₄ Cyclohexanemalonamic acid, 1-carboxy-, 268².
- C₁₀H₁₁N₂ Pyridine, amino-(tetrahydro-1-methyl-2-pyrryl)-, and *derivs.*, 694².
- C₁₀H₁₁N₂O Acetone, 4-p-tolylsemicarbazone, 478².
- Indazole, 3-acetamido-4,5,6,7-tetrahydro-7-methyl-, 1263².
- Semicarbazide, isopropylphenyl-, 642⁹.
- C₁₀H₁₁N₂O₃ 3-Pyrrololecarboxylic acid, 1,2,4-triamido-2,5-dimethyl-, Et ester, 1420⁹.
- C₁₀H₁₁ (See also *Camphene*; *Limonene*; *Phellandrene*; *Pinene*; *Terpinene*; *Terpinolene*.)
- Butine, cyclohexyl-, 966⁹.
- Carene, 1928².
- Compd. from Me verbanylanthracene, b₇₁₅ 156-7°, 53⁴.
- Crithmene, 1614².
- Dipentene, 1402², 3055¹, 3674¹.
- Diprene, 52⁷, 647².
- D-d-Fenchene(?), 269⁴.
- Nopinene, 487², 2653².
- Octalin, 1262².
- Thujene, 1928².
- Tricyclene, 1264².
- C₁₀H₁₁BrNO α Campholenamide, bromo-, 487².
- C₁₀H₁₁BrNO₂ α - Camphorsulfonamide, β - bromo-, 1137².
- C₁₀H₁₁Br₂ Norcamphene, 2-bromo-2-(bromomethyl)-3,3-dimethyl-, 2653².
- C₁₀H₁₁Br₂N₂O Piperazine, 1,4-bis(2-bromopropionyl)-, 2830⁴.
- C₁₀H₁₁Br₂O₂ Cyclohexanecetic acid, 1,2-dibromo-, Et ester, 2329¹.
- C₁₀H₁₁Br₂ Diprene, tetrabromide, 52⁷.
- C₁₀H₁₁Cl₂ Pinane, 2,3-dichloro-, 54².
- Pinene, dichloride, 2653².
- C₁₀H₁₁Cl₂O₂ Sebacyl chloride, 2040⁹.
- C₁₀H₁₁Cl₂CrNO₂, 1385².
- C₁₀H₁₁Cl₂MnN₂, 1385².
- C₁₀H₁₁IN 2,6-Diethyl-1-methylpyridinium iodide, 2667².
- C₁₀H₁₁IN₂ Acetimidic acid, β -methyl- β -phenylhydrazide, methiodide, 256².
- C₁₀H₁₁I₂S Triallylsulfonium iodide, CHI₃ addn. compd., 1403².
- C₁₀H₁₁NNaO Camphor, oxime, Na salt, 2475².
- C₁₀H₁₁N₂ Cyclopentanone, azide, 2343².
- C₁₀H₁₁N₂O Camphoranamide, 3-cyano-, 1418².
- C₁₀H₁₁N₂O₂ Camphor, pernitroso-, 264², *derivs.*, 3087².
- Dioximine, m. 190°, of compd. from β -decahydronaphthone dibromide, 487².
- 1-Pyrazolecarboxylic acid, 3-methyl-, amyl ester, 2953².
- 3-Pyrazolecarboxylic acid, 1-amino-2,4,5-trimethyl-, Et ester, 1420⁹.
- C₁₀H₁₁N₂O₃ Barbituric acid, 5-ethyl-5-isobutyl-, p 78².
- 4-Pyridazinedicarboxylic acid, 4-ethyl-2,3,4,5-

- tetrahydro-3-keto-5-methyl-, Et ester, 3480^o.
 —, 2,3,4,5-tetrahydro-4-isobutyl-3-keto-6-methyl-, 3480^o.
 C₁₀H₁₁N₂O₅S₂ Aniline-2-thiosulfonic acid, 1-amino-4-diethyl-, 513^o.
 C₁₀H₁₁N₂O₇ Glutamic acid, glutamyl-, and salts, 638^o.
 C₁₀H₁₁N₄ Butyronitrile, α , α' -diazobis[α -methyl-, 1853^o.
 C₁₀H₁₁N₄O Cyclohexanenitrile, 1-ethyl-2-keto-, semicarbazone, 1262^o.
 C₁₀H₁₁N₄O₂ Histidin, N-alanyl-, Me ester, 1248^o.
 C₁₀H₁₁O (See also *Camphor*; *Citral*; *Hextone*; *Piperitone*; *Sabinol*.)
 Camphenilone, β -methyl-, 2945^o.
 Carvotanacetone, 3055^o.
 Fenchone, 648^o, 1264^o.
 Isobornylone, 269^o.
 Δ^2 -5-o-Menthenone, 53^o.
 Naphthalenone, octahydro-, 1269^o, 1270^o.
 2-Pentanone, 3- Δ^1 -cyclopentenyl-, 2032^o.
 Pinene, oxide, 2618^o.
 Pulegone, 1401^o, 1136^o.
 Verbanone, 52^o, 53^o.
 Verbenol, 52^o.
 C₁₀H₁₅O₂ (See also *Ascaridole*.)
 Camphor, hydroxy-, 2333^o, 3267^o.
 Cyclogeranic acid, 3252^o.
 Δ^1 -Cyclohexanecarboxylic acid, α , 3-dimethyl-, 2030^o.
 1,3-Cyclohexanedione, 5,5-diethyl-, 2032^o.
 Δ^1 -Cyclohexenecarboxylic acid, 2,2,4-trimethyl-, and salts, 2656^o.
 Diosphenol, 55^o, 487^o, 2654^o.
 Fenchenylic acid, and Ag salt, 554^o.
 Menthone, 1,2-epoxy-, 2644^o.
 Thymotinic alcohol, 3125^o.
 C₁₀H₁₅O₂ α -Campholenic acid, α -hydroxy-, and Ca salt, 487^o.
 Cyclohexanecarboxylic acid, 3-keto-2,2,4-trimethyl-, 2655^o.
 Cyclopentanecarboxylic acid, 2-keto-1,3-dimethyl-, Et ester, 239^o.
 β -Fenchenic acid, hydroxy-, 55^o.
 Nopinic acid, 487^o.
 Succinic anhydride, α , β -diethyl- α , β -dimethyl-, 1878^o.
 C₁₀H₁₅O₄ Camphoric acid, 2174^o; salts, 1996^o.
 Cycloheptanecarboxylic acid, 1-carboxy-, 268^o.
 1,1-Cyclohexanedicarboxylic acid, 1802^o.
 C₁₀H₁₅O₅ Camphorsulfonic acid, Ca salt, 1996^o; K salt, 2943^o.
 C₁₀H₁₅O₅ Malonic acid, acetonyl-, di-Et ester, 3480^o.
 Succinic acid, acetyl-, di-Et ester, 2326^o.
 C₁₀H₁₅O₆ Mannonic acid, tetramethyl-, lactone, 1181^o.
 Oxalacetic acid, ethoxy-, di-Et ester, 2478^o.
 Pseudoglucal, dihydro-, diacetate, 2478^o.
 C₁₀H₁₇Br Norcamphane, 2-bromo-2,3,3-trimethyl-, 2653^o.
 C₁₀H₁₇BrO₂ Glutaric acid, α -bromo- γ -methyl-, di-Et ester, 1408^o.
 C₁₀H₁₇Cl Camphane, 2-chloro-, 2818^o.
 Isobornyl chloride, 2818^o.
 Naphthalene, chlorodecahydro-, 1263^o.
 Norcamphane, 2-chloro-2,3,3-trimethyl-, 2653^o.
 C₁₀H₁₇ClO₂ Glutaric acid, α -chloro- γ -methyl-, di-Et ester, 1408^o.
 C₁₀H₁₇IO₂ Glutaric acid, α -iodo- γ -methyl-, di-Et ester, 1408^o.
 C₁₀H₁₇N Camphene, α -amino-, 1264^o.
 C₁₀H₁₇NO Fenchone, β -oxime, 648^o.
 Piperitone, oxime, 1030^o.
 Verbanone, oxime, and HCl, 53^o.
 C₁₀H₁₇NO₂ Isobornylane, nitro-, 2008^o.
 Succinimide, α , β -diethyl- α , β -dimethyl-, 1853^o.
 C₁₀H₁₇NO₂ Amide from the 3-monooxime of 5,4-pinanedione, m. 120^o, 53^o.
 Cyclohexanecarboxylic acid, 3-keto-2,2,4-trimethyl-, β -oxime, 2655^o.
 C₁₀H₁₇NO₂ Cyclohexanecarboxamide, 4,5-dihydroxy-1,2-isopropylidenedioxy-, 2042^o.
 C₁₀H₁₇N₂O₁₁B₂V, 2174^o.
 C₁₀H₁₇N₂O₂ 2-Butanone, 3- Δ^1 -cyclopentenyl-, semicarbazone, 2032^o.
 Δ^2 -2-Nominone, semicarbazone, 2953^o.
 Semicarbazone, m. 204^o, of compd. made from chenopodium oil, 2942^o.
 C₁₀H₁₇N₂O₂ Barbituric acid, 5-(β -dimethylaminoethyl)-5-ethyl-, and HCl, 1580^o.
 C₁₀H₁₇ (See also *Decalin*.)
 Bicyclo[0.3.3]octane, 2,8-dimethyl-, 2949^o.
 Camphenilane, β -methyl-, 2945^o.
 Carvomenthene, 3055^o.
 Dipentene, 3604^o.
 Hydrocarbon from 2-isobornylanamine, b.p. 160-1^o, 269^o.
 Isobornylane, 269^o.
 Norcamphane, 2,3,3-trimethyl-, 2653^o.
 2,4-Octadiene, 4-ethyl-, 1852^o.
 Pinane, 3087^o.
 Pinene, dihydro-, 2333^o.
 C₁₀H₁₇ClNO α -Terpineol, nitroschloride, 486^o.
 C₁₀H₁₇ClNO₂ Leucine, N-chloroacetyl-, Et ester, 2052^o.
 C₁₀H₁₇Cl₂ Diprene, di-HCl, 52^o.
 C₁₀H₁₇CuO₂ Δ^1 -3-Heptenone, 5-hydroxy-4-methyl-, ethoxycopper salt, 1558^o.
 C₁₀H₁₇N₂ Camphenilone, β -methyl-, hydrazone, 2945^o.
 Verbanone, hydrazone, 52^o.
 C₁₀H₁₇N₂O₂ Hydantoin, 5-isobutyl-5-propyl-, 376^o.
 Verbanone, 2-hydroxamino-, oxime, 52^o.
 C₁₀H₁₇N₂O₂ Allophanic acid, 2,4-dimethylcyclohexanol ester, 1702^o.
 Cyclohexanemalonamide, 2-hydroxy-4-methyl-, 2644^o.
 C₁₀H₁₇O (See also *Borneol*; *Cineol*; *Citronellal*; *Geraniol*; *Isoborneol*; *Isopulegol*; *Linalol*; *Menthone*; *Nerol*; *Terpineol*.)
 Camphenilol, β -methyl-, 2945^o.
 Fenchyl alcohol, 2656^o.
 Δ^2 -3-Heptenone, 2,4,4-trimethyl-, 1134^o.
 2-Isobornylamyl-, 269^o.
 5-o-Menthanone, 53^o.
 Naphthol, decahydro-, 1270^o, 2949^o.
 Verbanol, 52^o.
 C₁₀H₁₇O₂ Compd., m. 69-71^o, from lemon oil, 3561^o.
 Nopinene glycol, 487^o.
 Sebaccaldehyde, and NaHSO₂ compd., 2041^o.
 C₁₀H₁₇O₂ Caproic acid, α -acetyl-, Et ester, 470^o, 1244^o.
 Caprylic acid, α -formyl-, Me ester, 468^o.
 Cyclohexanecarboxylic acid, α -hydroxy-, Et ester, 983^o.
 —, 1-hydroxy- α , 3-dimethyl-, 2030^o.
 Cyclohexanecarboxylic acid, 3-hydroxy-2,4-trimethyl-, 2656^o.
 Valeric anhydride, 3010^o.
 C₁₀H₁₇O₂ Malonic acid, isopropyl-, di-Et ester, 2641^o.

—, propyl-, di-Et ester, 2641².

Suberic acid, di-Me ester, $SnCl_4$ addn. compd., 50².

Succinic acid, α, β -diethyl- α, β -dimethyl-, 1853².

$C_{10}H_{17}O_3$ Isovaleric acid, α, α' -thiobis-, 923².

$C_{10}H_{17}O_3S_2$ Acetic acid, ethylenedithiobis-, di-Et ester, complex salts, 3253^{2,3}, 3254¹.

$C_{10}H_{15}O_4$ Galactonic acid, tetramethyl-, lactone, 974².

Galactonolactone, tetramethyl-, 1407².

Pseudoglucal, tetrahydro-, diacetate, 2478².

Succinic acid, α, β -diethoxy-, Et ester, and K salt, 1992².

$C_{10}H_{17}O_3$ Glutaric acid, α, β, γ -trimethoxy-, di-Me ester, 1409².

$C_{10}H_{15}Br$ 1-Octene, 8-bromo-2,6-dimethyl-, 2029².

$C_{10}H_{15}Br_2O$ Cineole hydrobromide perbromide, 816².

$C_{10}H_{15}IN_2$ Pyrazole, 3,5-dimethyl-1-propyl-, ethiodide, 2953².

$C_{10}H_{17}N$ 2-Isobornylamine, 269².

4-Pinamine, and salts, 53¹.

$C_{10}H_{17}NO$ Lupinin, 93¹.

2-Propanone, 1-(cyclohexylmethylamino), 511².

$C_{10}H_{17}NO_2$ Acetoacetamide, β, β -dipropyl-, 376¹.

—, β -ethyl- β -isobutyl-, 376¹.

$C_{10}H_{17}NO_2$ Glycine, N-caproyl-, Et ester, 2051².

$C_{10}H_{17}NO_2$ Δ^1 -5-Nonenone, semicarbazone, 466².

Oxtenone, methyl-, semicarbazone, 466², 2474^{2,4}.

$C_{10}H_{17}N_2O_4$ Glycine, [N-(N-glycyl)leucyl]-, 2503².

—, [N-(N-leucyl)glycyl]-, 2503².

$C_{10}H_{18}$ Cyclodecane, 2949².

o-Menthane(?), 53¹.

$C_{10}H_{18}I_2S_2$ Allyldipropylsulfonium iodide, $C_{11}H_{14}$ addn. compd., 1403².

$C_{10}H_{17}N_2$ Biperidine, 1310².

$C_{10}H_{17}N_2O_2$ Hydrazine, s-divaleryl-, 815².

Schalcdehyde, dioxime, 2041¹.

$C_{10}H_{17}N_2O_2$ Carhamic acid, isobutylidenecis-, di-Et ester, 2474².

$C_{10}H_{17}N_2O_2$ Piperazine, 1,4-dialanyl-, and di-HBr, 2830².

$C_{10}H_{17}O$ (See also Citronellol; Isomenthol, Menthol.)

Cyclohexaneethanol, β, β -dimethyl-, 203².

Cyclohexanol, 2-isobutyl-, 1862².

2-Decanone, 2807².

Linalol, dihydro-, 3055¹.

Neomenthol, 3480².

Δ^1 -3-Octenol, 3-ethyl-, 1852².

Rhodinol, 1473², 2635².

$C_{10}H_{17}O_2$ (See also Terpinol.)

α -Capric acid, 1174¹, 1695^{2,3}, 3081², 3251², 3396¹.

Caproic acid, α -butyl-, 1244².

2-Heptanol, 3-methyl-, acetate, 239².

Pelargonaldehyde, θ -hydroxy-, hemimethyl-acetal, 468².

Valeric acid, amyl ester, 2642².

$C_{10}H_{17}O_4$ Galactose, 2,3,5,6-tetramethyl-, 974¹.

d-Glucose, tetramethyl-, 2642².

2-Propanone, 1,3-dihydroxy-, Et cyclo-acetal, 247².

$C_{10}H_{17}O_2$ Mannonic acid, tetramethyl-, 3256².

$C_{10}H_{17}Br$ Octane, 1-bromo-3,7-dimethyl-, 2030².

$C_{10}H_{17}O_2N_2$ 617².

$C_{10}H_{17}N$ Cyclohexylamine, 2-isobutyl-, and salts, 1867².

Methylamine, 3366².

$C_{10}H_{17}NO$ Cyclohexanol, 3-diethylamino-, 2194².

$C_{10}H_{17}NO_2$ Galactonamide, tetramethyl-, 1408².

$C_{10}H_{17}N_2O$ 3-Octanone, 7-methyl-, semicarbazone, 2474².

$C_{10}H_{17}ClTi$ Diisooamylthallic chloride, 3439².

$C_{10}H_{17}FTi$ Diisooamylthallic fluoride, 3439².

$C_{10}H_{17}IN$ 1-sec-Butyl-1-methylpiperidinium iodide, 288².

$C_{10}H_{17}N_2O_4$ Hydrazine, s-di-sec-butyl-, oxalate, 3477².

—, s-diisobutyl-, oxalate, 3478².

$C_{10}H_{17}O$ Amyl ether, 1693².

Isoamyl ether, 1693².

Octanol, dimethyl-, 1471².

$C_{10}H_{17}O_2$ Acetaldehyde, di-Bu acetal, 1556², 1694².

—, diisobutyl acetal, 1556².

Butyraldehyde, diisopropylacetal, 1694².

—, dipropyl acetal, 1694².

3,4-Heptanediol, 2-ethyl-6-methyl-, 352².

Isobutyraldehyde, diisopropyl acetal, 1694².

3,5-Octanediol, 4-ethyl-, 1852².

$C_{10}H_{17}O_2$ Ether, bis(β -propoxyethyl), 634².

$C_{10}H_{17}O_2S_2$ d-Glucose diethyl mercaptal, 2056².

$C_{10}H_{17}Br_2ClCoN_4$ + 0.5 H₂O, 67².

$C_{10}H_{17}ClCoIN_4$, 67².

$C_{10}H_{17}ClCoN_4O_4$, 67².

$C_{10}H_{17}Cl_2CoN_4O_4$, 67².

$C_{10}H_{17}Cl_2CoN_4$ + H₂O, 67².

$C_{10}H_{17}N$ Butylamine, N,N, α -triethyl-, 288².

Diisoamylamine, -H₂, 1403².

$C_{10}H_{17}NO$ Ethanol, 2-di-sec-butylamino-, P 153².

1-Pentanol, 2-diethylamino-4-methyl-, p-aminobenzoate, P 3567¹.

$C_{10}H_{17}MoN_2O_2$ Piperidinium molybdate, 2191².

$C_{10}H_{17}N_2$ Ethylenediamine, N,N,N',N'-tetraethyl-, and salts, 653².

$C_{10}H_{17}N_2$ See Spermine.

$C_{10}H_{17}Cl_4MnN_2$, 1385².

$C_{10}H_{17}Sn_2$ Stannopropane, diethylhexamethyl-, 3250².

$C_{10}H_{17}Cl_2CoN_4$ + H₂O, 68².

$C_{11}H_{17}BrClO$ 1-Naphthyl chloride, 5-bromo-, 1562².

$C_{11}H_{17}ClIN_2O_2$ Pyridine, 4-chloro-3-nitro-, picrate, 72².

$C_{11}H_{17}IN_2O$ Ketone, 3,4,5-triiodo-2-pyrrolyl phenyl-, 1421².

$C_{11}H_{17}ClO_2$ 1-Naphthol, chloroformate, 3269².

$C_{11}H_{17}IN_2O$ Ketone, 3,4-diiodo-2-pyrrolyl phenyl-, 1421².

$C_{11}H_{17}N_2O_2$ Hydatoin [Δ^1]oxindole, 507¹.

Hydatoin [Δ^1]pseudogindoxyl, 507².

$C_{11}H_{17}N_2O_4$ 4,5-Limidazolecarboxylic acid, 2-(π -nitrophenyl)-, and NH₄ salt, 987².

$C_{11}H_{17}$ 1,3-Pentadiene, 1-phenyl-, 2635².

$C_{11}H_{17}BrNO_2$ Naphthalene, 5-bromo-2-methyl-1-nitro-, 2487².

$C_{11}H_{17}Br_2N_2O$ 2-Furaldehyde, (dibromophenyl)-hydrazone, 44², 45¹.

$C_{11}H_{17}Br_2O$ 2(1)-Naphthalenone, 1,6-dibromo-1-methyl-, 59².

$C_{11}H_{17}Br$ 1,3-Pentadiene, 1,2,3,4-tetra-bromo-1-phenyl-, 2635^{2,4}.

$C_{11}H_{17}ClIN_2O_2$ Pyrazole, chloro-methyl-1-(nitrobenzoyl)-, 2953².

$C_{11}H_{17}INO_2$ Cinchoninic acid, 8-iodo-2-methyl-, 566².

$C_{11}H_{17}IN_2O_2$ Pyridine, 2-amino-5-iodo-, picrate, 1424².

$C_{11}H_{17}IN_2O_2$ Proline, 5-keto-3-(3,4,5-tri-iodophenyl)-, 2203².

- C₁₁H₇N₃** Pyridindole, 507⁴; *methosulfate*, 2956⁵.
C₁₁H₇N₃O Cinchoninonitrile, 7-methoxy-, 293⁴.
C₁₁H₇N₃O₂ 5(4) - Isoxazolone, 3 - (3 - indyl)-, 279⁴.
C₁₁H₇N₃O₂ Naphthalene, 2-methyl-1,5-dinitro-, 2487⁴.
C₁₁H₇N₃O₂ 1,2,3 - Benzotriazole, 1 - (4 - pyridyl), and -HCl, 507⁴.
C₁₁H₇O 1-Naphthaldehyde, 3261⁴.
C₁₁H₇O₂ 1-Naphthoic acid, 1265⁴.
 2-Naphthol, formate, 47⁴.
 1,2-Naphthoquinone, 6-methyl-, 2819⁴.
C₁₁H₇O₂ Coumarin, acetyl-, 620⁴.
C₁₁H₇O₂ 1-Naphthoic acid, 2,7-dihydroxy-, 828⁴.
C₁₁H₇O₂ 1,2-Benzopyran-4-acetic acid, 7-hydroxy-2-keto-, 824⁴.
 Succinic anhydride, (3,4-methylenedioxy-phenyl)-, 1701⁴.
C₁₁H₇O₂ Phthalonic acid, 4(or 6)-carboxy-6(or 4)-methyl-, 483⁴.
C₁₁H₇Br Naphthalene, bromomethyl-, 2487⁴.
C₁₁H₇BrO Naphthalene, 1-bromo-5-methoxy-, 495⁴.
 2(1) - Naphthalenone, 1 - bromo - 1 - methyl-, 59⁴.
 1 - Naphthol, 5 - bromo - 2 - methyl-, 2487⁴.
C₁₁H₇BrO₂ Compd., m. 227-8°, from 3-phenyl-1,2 - cyclopropanedicarboxylic acid, 2043⁴.
 Paraconic acid, 2-(bromophenyl)-, 495⁴, 987⁴.
C₁₁H₇Br₂NO₂ 2-Butanone, 3,4-dibromo-3-hydroxy-4-phenyl-, thiocyanate, 2329⁴.
C₁₁H₇ClO₂S 2 - Naphthalenesulfonyl chloride, 6-methyl-, 2819⁴.
C₁₁H₇ClO₂ Resorcylyl chloride, diacetate, 2601⁴.
C₁₁H₇NO Ketone, phenyl 2-pyrryl, 1421⁴.
 Pyridine, 2-phenoxy-, 68⁴.
 2(1)-Pyridone, 1-phenyl-, 68⁴.
C₁₁H₇NO₂ 2 - Butenone, 3 - hydroxy - 4-phenyl-, thiocyanate, 2329⁴.
C₁₁H₇NO₂ 2-Naphthoic acid, 6-amino-, 2820⁴.
 2-Naphthol, 6-methyl-1-nitroso-, 2819⁴.
 Nitroform, α -2-furyl-N-phenyl-, 1258⁴.
C₁₁H₇NO₂ Cinchoninic acid, 3-hydroxy-2-methyl-, 1573⁴.
 —, 7-methoxy-, 292⁴.
 2 - Indolecarboxylic acid, 3-formyl-5-methyl-, 830⁴.
 3-Indoleglyoxylic acid, Me ester, 279⁴.
 2-Naphthol, 6-methyl-1-nitro-, 2819⁴.
 Quinaldic acid, methoxy-, 292⁴.
C₁₁H₇NO₂ Malononitrile, anisalamino-, 2810⁴.
C₁₁H₇NO₂ Resorcinol, 4-pyridylazo-, 70⁴.
C₁₁H₇NO₂ Pyrazole, 3-methyl-1-(o-nitrobenzoyl)-, 2953⁴.
C₁₁H₇NO₂S 3 - Pyridinesulfonic acid, 4 - (dihydroxyphenylazo)-, 1276⁴.
C₁₁H₇NO₂ Benzyl alcohol, 3-hydroxy-4-nitro-2,6-dinitroso-, diacetate, 2037⁴.
C₁₁H₇NO₂ Pyridine, 4-amino-, picrate, 70⁴.
C₁₁H₇Br Naphthalene, methyl-, 2800⁴, 2948⁴.
C₁₁H₇BrN 1 - Naphthylamine, 5 - bromo - 2 - methyl-, 2487⁴.
C₁₁H₇Br₂NO₂ 1,3,4 - Thiodiazole, 3 - acetyl-2 - (p - bromophenylimino) - 2,3 - dihydro - 5 - methylmercapto-, 988⁴.
C₁₁H₇Br₂O₂ Glutaric acid, α , γ -dibromo- β -phenyl-, 2643⁴.
C₁₁H₇ClNO Lepidifac chloromethoxy-, 292⁴, 293⁴.
 2(1) - Quinolone, 4 - chloro - 1 - ethyl-, 292⁴.
C₁₁H₇Cl₂N₂O Antipyrine, 2',4'-dichloro-, 508⁴.
C₁₁H₇Cl₂F₂O₂ Proline, 3-(4-amino-3,5-diiodophenyl)-5-keto-, 2403⁴.
C₁₁H₇NO₂ 3,5-Toluenediacetonitrile, 1564⁴.
C₁₁H₇NO₂O Pyrazole, 1-acetyl-3(or 5)-phenyl-, 2049⁴.
 —, 1-benzoyl - 3 - methyl-, 2953⁴.
C₁₁H₇NO₂O₂ m - β - Benzobisoxazole, 2,5,7-trimethyl-, 2649⁴.
 Indazole, 3-acetyl-, acetyl deriv., 508⁴.
 Indole, 2-methyl-3-(nitrovinyl)-, 505⁴.
 1-Naphthylamine, methylnitro-, 2487⁴.
C₁₁H₇NO₂ 1,4 - Imidazopyridin - 2 - ol, 3-acetyl-, acetate, 1862⁴.
 3-Indoleglyoxylic acid, Me ester, oxime, 279⁴.
 3 - Isoindazolol, 1-acetyl-, Ac deriv., 508⁴.
C₁₁H₇NO₂O Proline, 5-keto-3-(p-nitrophenyl)-, 2203⁴.
C₁₁H₇NO₂O Imidazole, 1,2-dimethyl-5-nitro-, picrate, 3271⁴.
C₁₁H₇O Ether, methyl 2-naphthyl, 1258⁴, 1265⁴.
 2-Naphthol, 6-methyl-, 2487⁴, 2819⁴.
 α , γ -Pentadienaldehyde, δ -phenyl-, 2940⁴.
C₁₁H₇O Chromone, 2,6-dimethyl-, 519⁴.
 2-Naphthoic acid, 3,4-dihydro-, 261⁴.
 2-Naphthol, 6-methoxy-, 498⁴.
 α , γ -Pentadienic acid, δ phenyl-, 2475⁴.
C₁₁H₇O₂ Acrylic acid, β benzoyl- α -methyl-, 983⁴.
 Δ^2 - 2 - Butenone, 4 - (3,4 - methylenedioxy-phenyl)-, 484⁴.
 Hydroxycarboxylic acids, m 164° and 183°, from atromentin, 639⁴.
 1 - Indanacetic acid, 3-keto-, 491⁴.
 1 - Indanone, 2 hydroxy, acetate, 66⁴.
 2-Naphthoic acid, 3,4-dihydro-1-hydroxy, and Cu salt, 261⁴.
C₁₁H₇O₂S 2 - Naphthalenesulfonic acid, 6-methyl-, and salt, 2819⁴.
C₁₁H₇O₂ Chromone, 7 hydroxy-3-methoxy 2 methyl-, 517⁴.
 Succinic anhydride, anisyl-, 1701⁴.
 Umbelliferone, 3,4-dihydro-, acetate, 2639⁴.
C₁₁H₇O₂ Phthalonic acid, 4,6 dimethyl-, 483⁴.
C₁₁H₇O₂ Mandelic acid, dicarboxymethyl-, 483⁴.
C₁₁H₇AgClNO₂ Carbamic acid, hydroxy, Pr ester, p-chlorobenzoate, Ag salt, 970⁴.
C₁₁H₇AgNO₂ Carbamic acid, hydroxy, Pr ester, m (and p) - nitrobenzoate, Ag salt, 970⁴.
C₁₁H₇Br₂NO Crotonaldehyde, α -bromo, benzoylhydrazine, 2953⁴.
C₁₁H₇ClIN Compd, decomps. C12°, from 4 chloroquinaldine and MeI, 1279⁴.
C₁₁H₇ClIN Pyrazole, 1 benzylchloromethyl-, 2952⁴.
 —, chloro 1-ethylphenyl-, 2953⁴.
C₁₁H₇ClIN₂O Antipyrin, chloro-, 507⁴.
 Pyrazole, 1 - acetylchlorophenyl-, 2953⁴.
C₁₁H₇ClO₂ Acetic acid, benzoylchloro, Et ester, 2931⁴.
C₁₁H₇Cl₂NO₂ Addn. compd. of p-toluidine and trichloroacetic acid, 3190⁴.
C₁₁H₇HgNO₂ o-Cresol, bis(hydroxymethylmercuri)-nitro-, diacetate, P 3567⁴.
C₁₁H₇N Naphthylamine, methyl-, 2487⁴, 2820⁴.
C₁₁H₇NO 2-Naphthol, 1-amino-6-methyl-, 2819⁴.
 2 - Naphthylamine, methoxy-, and -HCl, 497⁴, 498⁴.
 Quinaldine, methoxy-, 293⁴, 2668⁴; and de- 1279⁴, 1279⁴.

- C₁₁H₁₁NO₂** Carbostyryl, 7-methoxy-4-methyl-, 292².
 Oxazole, 5-ethoxy-2-phenyl-, 2051¹.
 2(1)-Pyridone, 4-furyl-1,6-dimethyl-, 2497³.
 4 - Quinolinol, 7 - methoxy - 2 - methyl-, and -HCl, 292², 493¹.
- C₁₁H₁₁NO₂S** 2 - Naphthalenesulfonamide, 6-methyl-, 2819⁷.
- C₁₁H₁₁NO₃** Hydrocinnamic acid, α -cyano-*p*-methoxy-, 485².
 3-Indolepropionic acid, 2-hydroxy-, 2048¹, 3539⁷.
 5 - Oxazolidone, 3 - acetyl - 2 - phenyl, 2639⁹.
 Δ^2 - Oxazoline - 4 - carboxylic acid, 2 - phenyl-, Me ester, and -HCl, 638².
 Proline, 5-keto-3-phenyl-, 2203⁷.
 3 - Pyrrolidinedicarboxylic acid, 2 - keto - 1-phenyl-, 2808⁸.
- C₁₁H₁₁NO₃** 1,2 - Indandione, 5,6 - dimethoxy-, 2-oxime, 2662⁹.
 1,3(2,4) - Isoquinolinedione, 6,7 - dimethoxy-, 2662⁹.
 Veratric acid, β - (cyanomethyl)-, 2662⁹.
- C₁₁H₁₁NO₄** Aspartic acid, *N*-salicylal-, *Ba* salt, 2639⁹.
 Glutaric acid, α -keto- β -phenyl-, oxime, 2203⁷.
- C₁₁H₁₁NO₄** Cinnamic acid, 3,4-dimethoxy-5-nitro-, 2652⁸.
 Meconin, 2-nitromethyl-, 261².
 Phthalic acid, 3-nitro - 2 isopropyl ester, 2410¹.
- C₁₁H₁₁N₃** *o* - Phenylenediamine, *N* - pyridyl, and -HCl, 507².
- C₁₁H₁₁N₃OS** 1,4,3 - Isothiodiazine, 2-acetamido-5-phenyl-, 831⁹.
 2(3)-Thiazolone, 4 phenyl-, acetylhydrazone, 832¹.
- C₁₁H₁₁N₃OS₂** 1,3,4 - Thiodiazole - 2 - mercaptan, 4 - acetyl - 4,5 - dihydro - 5 - *p* - tolyl imino-, 988².
- C₁₁H₁₁N₃O₂** Creatinine, 2(or 3)-benzoyl-, 1853¹.
 2,4(1,3) - Quinazolinone, 3 - isopropylideneamino-, 1130⁴.
 1,2,3 - Triazole - 4 - carboxylic acid, 5-methyl-1-*o*-tolyl-, 176⁹.
- C₁₁H₁₁N₃O₂** Antipyrine, 4-nitro-, 2040⁷.
 1 - Indancarboxylic acid, 3 keto-, semicarbazono-, 494².
- C₁₁H₁₁N₃S₂** 1,4,3 - Isothiodiazine - 2 - carbamic acid, methyl 5-phenyldithio-, 832¹.
- C₁₁H₁₁N₃** *m* - Phenylenediamine, 4 - pyridylazo-, 70².
- C₁₁H₁₁NaO₄** See *Benzoin*.
- C₁₁H₁₂** Hydrocarbon from 3,5-toluenediacetonitrile, 1564⁹.
 Naphthalene, 1,2 - dihydro - 4 - methyl-, 1569¹, 2201⁷.
 ---, 1,2,3,4 - tetrahydro 1 - methylene-, 1569¹, 2201⁷.
- C₁₁H₁₂Br₂** Dibromide of hydrocarbon from 3,5-toluenediacetonitrile, 1565¹.
- C₁₁H₁₂Br₂N₂O₂** Malonamide, α -bromo-*N*-(*p*-bromophenyl)-*N'*-ethyl-, 1697¹.
- C₁₁H₁₂Br₂O₂** Hydrocinnamic acid, α,β - dibromo-*p*-methoxy-, Me ester, 3264².
- C₁₁H₁₂Br₂O₄** *p*-Toluic acid, 3,5-dibromo-2,6-dimethoxy-, Me ester, 1260⁹.
- C₁₁H₁₂Br₄** Pentane, 1,2,3,4 - tetrabromo - 1-phenyl-, 2635².
- C₁₁H₁₂ClO₄** Carbamic acid, hydroxy-, Pr ester, *p*-chlorobenzoate, 970¹.
- C₁₁H₁₂INO** 3-Hydroxy-1,2-dimethylquinolinium iodide, 1278⁹.
- C₁₁H₁₂INS** Thiazole, 2 - methyl - 5 - phenyl-, methiodide, 1706¹.
- C₁₁H₁₂I₂N₂** Pyrazole, 5 - iodo - 4 - methyl - 3-phenyl-, methiodide, 2953¹.
- Q₁₁H₁₂NO₃Sb** Benzoic acid, *m*-amino-, anti-monyl tartrate, 256².
- C₁₁H₁₂N₂** Indazole, 2-allyl-5-methyl-, 511⁹.
 Isoindazole, 1 allyl-5-methyl-, 511⁹.
 Naphthylenediamine, 2-methyl-, 2487³, 7.
 Pyrazole, 1-ethyl-3-phenyl-, 2049⁴.
 3,9-Pyridindole, 1,2,3,4-tetrahydro-, 507².
- C₁₁H₁₂N₂O** (See also *Antipyrine*.)
 α -Cresol, 6-(5-methyl-3-pyrazolyl)-, 1423².
 Crotonaldehyde, benzoylhydrazon-, 2953⁷.
 Isoindazole, 1-isobutyl-, 509⁸.
 ---, 3 - methyl - 1 - propionyl-, 509⁸.
 Pyrazolone, benzylmethyl-, 2931⁸, 2952⁸.
 Vasicine, 3323⁹; and salts, 2501².
- C₁₁H₁₂N₂O₂** (See also *Tryptophan*.)
 2 - Indazolecarboxylic acid, 5 - methyl-, Et ester, 512¹.
 β Pentenic acid, γ -phenylazo-(?), 2326⁹.
- C₁₁H₁₂N₂O₂S** Hydantoin, 3-*p*-phenetyl-2-thio-, 637².
- C₁₁H₁₂N₂O₂** Glycine, *N* - (*N* - benzalglycyl)-, *Ba* salt, 2639⁹.
 Glyoxylanilide, *p*-allyloxy-, oxime, 2646².
 Hydantoin, 3-*p*-phenetyl-, 637².
 5(4) - Isoxazolone, 3 - *p* - phenetidino-, 471⁶.
 Proline, 3 - (*p* - aminophenyl) - 5 - keto-, 2203⁷.
- C₁₁H₁₂N₂O₄** Benzohydroxamic acid, *o*-amino-, diacetyl deriv., 508⁹.
 Glycine, *N* - *p* - nitrobenzal-, Et ester, 2437⁹.
 ---, *N* - (*N* - salicylalglycyl), *Ba* salt, 2639⁹.
- C₁₁H₁₂N₂O₄** Carbamic acid, hydroxy-, Pr ester, *m* (and *p*)-nitrobenzoate, 970¹.
- C₁₁H₁₂N₂S** Imidazole, 2-ethylmercapto-1-phenyl-, 1710¹.
- C₁₁H₁₂N₂O₁₀** Valeric acid, δ -amino- α,γ -dihydroxy-, γ -lactone, picrate, 635¹.
- C₁₁H₁₂N₂O₂** Compd., m. 218⁹, from creatinine and trinitro-*m*-cresol, 1853¹.
 Creatinine, 3-methyl-, picrate, 653².
- C₁₁H₁₂O** 1-Indanone, 2-ethyl-, 494².
 γ -Pentenophenone, 1133⁹.
- C₁₁H₁₂O₂** Acrylphenone, β -ethoxy-, 2049².
 γ -Butenophenone, *p*-hydroxy-, 466⁹.
 Cinnamic acid, *p*, β -dimethyl-, 277².
 Hydrocinnamaldehyde, α -acetyl-, 2201⁷.
 2,4 - Pentanedione, 3-phenyl-, 1558⁹.
- C₁₁H₁₂O₂** 1,3-Butanedione, 1-(2,3-cresyl)-, 1423².
 Δ^2 - 2 - Butenone, 4 - (hydroxyanisyl)-, 484², 2944⁴.
 Butyric acid, β -benzoyl-, 503⁸.
 Eugenol, formate, 17⁹.
 Hydrocinnamic acid, α -acetyl-, 1569¹.
 Isoeugenol, formate, 47⁹.
 2 - Propanone, 1 - hydroxy - 3 - phenyl-acetate, 2206⁹.
- C₁₁H₁₂O₂** Acrylphenone, β -hydroxy-*p*, α -di-methoxy-, 2342⁹.
 γ -Butenophenone, 3,4,5-trihydroxy-, 466⁹.
 Cinnamic acid, 3,5-dimethoxy-, 2651¹.
 Homoterephthalic acid, 2,6-dimethyl-, 462⁹.
 Hydrocinnamic acid, α -(carboxymethyl)-, 824².
 Lactic acid, Me ester, benzoate, 244¹.
 Malonic acid, phenethyl-, 471².
Na salt—See *Benzoin*.
 3,5-Toluenediacetic acid, 1565¹.
 α -Toluic acid, α -(β -carboxyethyl)-, 261².

- C₁₁H₁₅O₅ Formic acid, (4-formyl-*o*-anisyl-), Et ester, 761.
Homoterephthalic acid, α -hydroxy-2,6-dimethyl-, 482^o.
Succinic acid, anisyl-, 1701¹.
C₁₁H₁₅O₅ Phthalic acid, 4-ethoxy-5-methoxy-, 2959^o.
Stearic acid, 4-hydroxy-*m*-anisyl-, 1701¹.
C₁₁H₁₅BrN₂O Malonamide, α -bromo-*N*-methyl-*N'*-*p*-tolyl-, 1697¹.
C₁₁H₁₅BrO Benzene, 1 - (γ -bromo- β -methoxypropyl) - 3,4 - methylenedioxy-, 1261¹.
C₁₁H₁₅BrO Acetophenone, α -bromo-2,4,6-trimethoxy-, 1260¹.
C₁₁H₁₅ClN₂O Crotonanilide, α -chloro- β -methyl-amino-, 43^o.
C₁₁H₁₅ClO Curcuml chloride, 277¹.
 α -Toluy chloride, α -ethyl-*p*-methyl-, 277¹.
C₁₁H₁₅ClO Acetophenone, 3-chloro-6-methoxy-2,4-dimethyl-, 2339^o.
C₁₁H₁₅ClO Ethanol, 2-(β -chloroethoxy)-, benzoate, 634¹.
Propiophenone, β -chloro-*or*, *or*-dimethoxy-, 283¹.
C₁₁H₁₅ClO Acetophenone, α -chloro-2,4,6-trimethoxy-, 1260¹.
C₁₁H₁₅HgNO₄ *m* - Toluidine, 2,5 - bis(acetox-mercuri)-, 501.
C₁₁H₁₅IN₂ Allylmethylindazolium iodide, 3091¹.
C₁₁H₁₅IN Indole, 2-propyl-, 1277¹.
 α -Tolunitrile, α -ethyl-*p*-methyl-, 277¹.
—, α -isopropyl-, 51¹.
C₁₁H₁₅NO 2-Pyrrolidone, 1-*p*-tolyl-, 2665¹.
C₁₁H₁₅NOS Δ^1 -(*o*)-2-*p*-Menthadienone, 1-hydroxy-(?), thiocyanate, 2329¹.
C₁₁H₁₅NO 4-Chromanone, 3-amino-2,8-dimethyl-, 1423¹.
Cinnamic acid, *p*-dimethylamino-, 2475¹.
Diacetamide, *N*-benzyl-, 3261¹.
Hydrocinamonitrile, 3,4-dimethoxy-, 2653¹.
3 - Hydroxy - 1,2 - dimethylquinolinium hydroxide, chloroplatinate, 1278¹.
C₁₁H₁₅NO (See also Hydrastinine.)
 α -Alkyl-*N*-benzoyl-, Me ester, 244¹.
Hydrocinnamic acid, *o*-acetyl-, oxime, 1569¹.
C₁₁H₁₅NO₂ Malonanilic acid, *p*-ethoxy-, β -thio-, 471¹.
C₁₁H₁₅NO Acetohydroxamic acid, ethoxy-, benzoate, and *K* salt, 240¹.
Benzoic acid, *p*-nitro-, Bu ester, 979¹.
Carbamic acid, hydroxy-, Pr ester, benzoate, 969¹.
Carbanilic acid, *p*-carboxy-, Et Me ester, 979¹.
Cinnamic acid, 3-amino-4,5-dimethoxy-, and -HCl, 2653¹.
Glutamic acid, β -phenyl-, 2203¹.
Propionohydroxamic acid, β -methoxy-, benzoate, and *K* salt, 240¹.
Serine, Me ester, benzoate, -HCl, 1652¹.
—, *N*-benzoyl-, Me ester, 638¹.
Styrene, ethoxymethoxy- β -nitro-, 2959¹.
p-Toluic acid, α -hydroxy-, Et ester, carbamate, 1417¹.
Tyrosine, acetyl-, 126¹.
Veratrole, 4-allyl-5-nitro-, 2844¹.
C₁₁H₁₅NO₃ Glyoxal, (3,4,5-trimethoxyphenyl)-, oxime, 2652¹.
Homoterephthalic acid, 4,5-dimethoxy-, 2663¹.
2,6 - Lutidine - 3,5 - dicarboxylic acid, 1,4-dihydro - 4 - keto-, mono- Et ester, 472¹.
Tyrosine, *N* - (carboxymethyl)-, acid Be salt, 257¹.
C₁₁H₁₅NO₃ 2 - Pyrrolocarboxylic acid, 4 - (β , β -dicarboxyethyl) - 3,5 - dimethyl-, 2823¹.
p - Toluic acid, 2,6 - dimethoxy - 3 - nitro-, Me ester, 1260¹.
C₁₁H₁₅N₃ 1,2,3 - Triazole, 4 - isopropyl - 1-phenyl-, 2341¹.
C₁₁H₁₅N₂O Antipyrine, 4-amino-, 2040¹.
 β - Butenamide, *N* - ψ - tolylimino-, oxime, 3261¹.
 Δ^1 - Pyrrolone, methylphenylcarbonyl-, 284¹.
C₁₁H₁₅N₂O 5-Pyrazolone, 3-*p*-phenetidino-, 476¹.
Urazole, 1-isopropyl-2-phenyl-, 642¹.
C₁₁H₁₅N₂O Δ^1 - Pyrazoline, 3 - (3,4 - dimethoxyphenyl)nitroso-, 283¹.
C₁₁H₁₅N₂S 1,4,3 - Isothiadiazine, 2 - ethyl-amino - 5 - phenyl-, *HI*, 831¹.
C₁₁H₁₅F₂O Picrate, *m*. 142.5^o, of base from 1,2-dimethyl - 5 - nigroimidazole, 3271¹.
C₁₁H₁₅Br₂N₂O Arabinose, (3,5-dibromophenyl)-hydrazone, 44¹.
C₁₁H₁₅ClNO *p*-Butyrololide, γ -chloro-, 2664¹.
C₁₁H₁₅ClNO Acetophenone 3-chloro- β -methoxy-2,4-dimethyl-, oxime, 2339¹.
C₁₁H₁₅ClN₂O Acetophenone, 5-chloro-3-ethyl-2-hydroxy-, semicarbazone, 271¹.
C₁₁H₁₅NO₂Sb + 0.5H₂O Benzylamine, antimonyl tartrate, 1256¹.
C₁₁H₁₅N₂ Imidazole, 4,5 - dihydro - 4,5 - dimethyl-2-phenyl-, 984¹.
Indazole, 2-isobutyl-, 3091¹.
C₁₁H₁₅N₂O Antipyrine, dihydro-, 2040¹.
C₁₁H₁₅N₂OS Base, *m*. 92-3^o, from α - (β , β -diethoxyisopropyl) - β - phenylthiourea and H₂SO₄, 1710¹.
Oxazolidine, 2 - imino - 5 - (tolylmercaptomethyl)-, 2052¹.
C₁₁H₁₅N₂O Carbazic acid, β - (α - methylbenzal-, Et ester, 2953¹.
Glycinanilide, *p*-allyloxy-, 2646¹.
Malonamide, *N*-ethyl-*N'*-phenyl-, 1697¹.
—, *N*-methyl-*N'*-*p*-tolyl-, 1696¹.
—, α -phenethyl-, 471¹.
 Δ^1 - Pyrazoline, 3 - (3,4 - dimethoxyphenyl)-, 283¹.
1, α - Spiro[cycloheptanesuccinimide], β -cyano-, 268¹.
C₁₁H₁₅N₂O Amino acid from casein, 2666¹.
Barbituric acid, 5-allyl-5- Δ^1 -butenyl-, P 153¹.
—, 5 - Δ^1 - cyclopentenyl - 5 - ethyl-, P 3566¹.
Glutaranilic acid, γ -amino-, 469¹.
C₁₁H₁₅N₂O₂ 2 - Benzimidazolemethanesulfonic acid, α - ethyl - 5(or 6) - methyl-, 37¹.
Hydantonic acid, δ - *p* - phenetyl - γ - thio-, 637¹.
C₁₁H₁₅N₂O₂ Carbamic acid, benzalbis-, di-Me ester, 2478¹.
— Dipicolinic acid, 4-amino-, diethyl ester, and -HCl, 70¹.
Phenylisocyanate, *m*. 1410, of amino acid from teosin, 976¹.
Toluene, 4-*tert*-butyl-2,6-dinitro-, 48¹.
Tyrosine, glycol-, 2347¹.
C₁₁H₁₅N₂S Thiazolidine, 2 - (ethylimino) - 3 - phenyl-, and -HCl, 2481¹.
—, 3 - ethyl - 2 - phenylimino-, and -HCl, 2481¹.
C₁₁H₁₅O Acetophenone, 2,4,6 - trimethyl-, 482¹.
Benzofuran, 1 - ethyl - 1,3 - dihydro - 2 - methyl-(?), 2038¹.
2 - Butanone, 3 - methyl - 1 - phenyl-, 1899¹.
Chroman, 2,4 - dimethyl-(?), 2038¹.
Ether, ethyl γ -phenylallyl-, 2645¹, 3248¹.

- , *o* - methyl - Δ^2 - butenyl phenyl-, 2038⁷.
 2 Pentanone, 1-phenyl-, 1890⁷.
 Phenol, *o* - (α - methyl - Δ^2 - butenyl)-, 2038⁷.
 C₁₁H₁₄O₂ Acetophenone, 2-ethoxy-5-methyl-, 1405⁸.
 —, 6-hydroxy-2,4,4-trimethyl-, 2340¹.
 —, 2-methoxy-3,5-dimethyl-, 1405⁸.
 2-Butanol, 4-phenyl-, formate, 2331³.
 2-Butanone, 3-*p*-anisyl-, 823².
 Curcumin acid, and salts, 277^{1,2}.
 Eugenol, methyl-, 376¹, 646⁸.
 Homoanisaldehyde, α , α -dimethyl-, 823².
 Hydrocinnamic acid, Et ester, SnCl₄ addn. compd., 50⁷.
 Isobutyrophenone, *p*-methoxy-, 823².
 Isoeugenol, methyl-, 646⁸.
 1,2-Naphthalenediol, 1,2,3,4-tetrahydro-1-methyl-, 1569⁴.
 2-Naphthol, 1,8,3,4-tetrahydro-7-methoxy-, 498¹.
 Propene oxide, 1-*p*-anisyl-2-methyl-, 823².
 Propiophenone, *op*-methoxy, 266⁸.
 Thymol, formate, 47⁵.
 α -Toluic acid, α -ethyl-*p*-methyl-, and Mg salt, 277⁸.
 —, α -isopropyl-, 51³.
p-Toluquinone, 5-*tert*-butyl-, 43¹.
 C₁₁H₁₄O₂ 2,6-Cresotic acid, 5-isopropyl-, P 1615².
 Isozingerone, 2944⁴.
p-Toluic acid, α -hydroxy-, Pr ester, 1417⁴.
 Zingerone, 2943⁴, 2944⁴.
 C₁₁H₁₄O₄ Acetophenone, trimethoxy-, 260¹, 1141⁴.
 C₁₁H₁₄O₄ Lactic acid, Me ester, *p*-toluenesulfonate, 244⁶.
 C₁₁H₁₄O₄ Δ^1 - Cyclohexenemalonic acid, 2-(carboxymethyl)-, 2329².
 C₁₁H₁₄O₄ Arabonic acid, γ -lactone, triacetate, 817².
 1,1,2,3 - Cyclopropanetetra-carboxylic acid, tetra-Me ester, 246⁴.
 C₁₁H₁₄Br Benzene, (β - bromo - β - methylbutyl)-, 1138⁴.
 C₁₁H₁₄BrN₂ 1 - Methyl - 2 - propylindazolium bromide, 3091².
 C₁₁H₁₄BrO Benzene, (γ -bromo- β -ethoxypropyl)-, 1261⁴.
 C₁₁H₁₄BrO₂ Anisole, *o*(and *p*) - (γ - bromo - β - methoxypropyl)-, 1261⁴.
 C₁₁H₁₄BrO₂ Camphocarboxylic acid, bromo-, 1524⁷.
 C₁₁H₁₄BrO₂ Xylose, triacetyl bromo-, 2034⁶.
 C₁₁H₁₄Cl Benzene, (α -chloroisooamyl)-, 2324².
 C₁₁H₁₄ClN₂ 1 - Methyl - 2 - propylindazolium chloride, 3091².
 C₁₁H₁₄ClO₂ Xylose, triacetylchloro-, 2034⁶.
 C₁₁H₁₄Cl₂N₂Sn 3227⁴.
 C₁₁H₁₄IN₂ Methylpropylindazolium iodide, 3091².
 C₁₁H₁₄IN₂S Benzothiazole, 5-dimethylamino-1-(methylmercapto)-, methiodide, 513⁸.
 1(2) - Benzothiazolone, 5 - dimethylamino-2-methyl-1-thio-, methiodide, 513⁸.
 C₁₁H₁₄N₂ Amine from 3,5-toluenediacetonitrile, 1564².
 Indansamine, *N*, *N*-dimethyl-, 1520⁸.
 —, *N*-ethyl-, 1520⁸.
 Isobutylamine, *N*-benzal-, 2645⁴.
 Pyrrolidine, 2-methyl-1-phenyl-, 1862¹.
 C₁₁H₁₄NO Acetophenone, α - (ethylmethylamino)-, 511².
m-Acetotoluide, *N*-ethyl-, 2648⁴.
 Camphor, α -cyano-, 825⁴.
 Indoline, 5 - methoxy - 1,3 - dimethyl-, 2048⁴.
 Isoquinoline, 1,2,3,4 - tetrahydro - 2 - β -hydroxyethyl-, 825¹.
 Morpholine, 4-*p*-tolyl-, 634².
 2 - Naphthylamine, tetrahydro - 7 - methoxy-, and HCl, 497¹, 498¹.
 α -Toluamide, α -ethyl-*p*-methyl-, 277⁴.
 Valerophenone, oxime, 982².
 C₁₁H₁₄NO₂ Acetophenone, 2-ethoxy-5-methyl-, oxime, 1405⁸.
 —, 6-hydroxy-2,3,4-trimethyl-, oxime, 2340¹.
 —, 2-methoxy-3,5-dimethyl-, oxime, 1405⁸.
 Benzamide, *N* - (β - hydroxyisobutyl)-, 3254⁴.
 Butesin, 1030⁸.
 Butyranilide, α - hydroxy - α - methyl-, 264².
 Isoquinoline, 1,2,3,4 - tetrahydro - 6,7-dimethoxy-, and HCl, 2955².
 Toluene, 4-*tert*-butyl-2-nitro-, 42⁸.
 C₁₁H₁₄NO₂ Methylamine, *N* - (3,4,5-trimethoxybenzyl)-, 2652².
 Pyrrolecarboxylic acid, 5-ethyl-4-formyl-3-methyl-, Et ester, 1429².
 —, 2-acetyl-4,5-dimethyl-, Et ester, 3270².
 C₁₁H₁₄NO₂ Acetophenone, α - amino - 3,4,5-trimethoxy-, -HCl, 2652⁴.
 —, 3,4,5-trimethoxy-, oxime, 2652².
 Benzamide, 3,4,5-trimethoxy-*N*-methyl-, and chlorostannate, 2651⁴.
 C₁₁H₁₄NO₄ α - Veratraldehyde, nitro-, dimethyl acetal, 4821⁴.
 C₁₁H₁₄N₂O α - Toluualdehyde, α , α - dimethyl-, semicarbazone, 823¹.
 C₁₁H₁₄N₂O₂ Propiophenone, hydroxymethyl-, semicarbazone, 271², 1405⁴.
 Valeraldehyde, α -2-fural-, semicarbazone, 1139¹.
 C₁₁H₁₄N₂O₂ Acetophenone, dimethoxy-, semicarbazone, 2342¹.
 • 1 - Methyl - 2 - propylindazolium nitrate, 3091².
 C₁₁H₁₄N₂O₂ Acetimidic acid, β -methyl- β -phenylhydrazide, oxalate, 256⁴.
 Benzaldehyde, β -aminoethylhydrazide, oxalate, 3250².
 C₁₁H₁₄N₂O₂ Salicylaldehyde, β -aminoethylhydrazide, oxalate, 3250².
 C₁₁H₁₄N₂O₂S Compd. from yeast, 1867⁸.
 C₁₁H₁₄S Benzene, amyl-, 977², 1899⁸.
 —, ethylpropyl-, 1222⁴.
 —, isooamyl-, 977².
 —, β -methylbutyl-, 977².
 1,10-Hendecadiene, 1850⁷; and Ag deriv., 433².
 C₁₁H₁₄AsS *p*-Thiarsane, 4-phenyl-, methiodide, 1412².
 C₁₁H₁₄AsNO₂ Carbanilic acid, arsonate, Bu and isobutyl ester, 979⁸.
 —, 5 - arsonate - 2 - methyl-, isopropyl and Pr esters, 979⁸.
 C₁₁H₁₄Br₂N₂O₂ Piperidazine, dibromo-*N*, *N'*-dicarbethoxyendomethylene-, 2499².
 C₁₁H₁₄ClN Aniline, *N*- γ -chloropropyl-*N*-ethyl-, 1862¹.
 C₁₁H₁₄Cl₂O₂ Glucoside, α -methyl-, 5,8-dichlorohydgin, diacetate, 2480¹.
 C₁₁H₁₄N₂O Acetotoluide, amino-*N*-ethyl-, P 403⁷.
 • Hydrazine, α -isobutyryl- β -tolyl-, 3254⁴.

- Ketone, δ - methylaminoethyl 3 - pyridyl, and di-HCl, 657².
- 2(1) - Pyridone, 3(or δ) - (tetrahydro - 1-methyl-2-pyrryl-, 2825².
- C₁₁H₁₇N₂O₅ Urea, ethyl(β -hydroxyethyl)phenylthio-, 2481⁴.
- C₁₁H₁₇N₂O₄ (See also *Pilocarpine*.)
- Isoneopilocarpine, and -HNO₃, 1709².
- Nepilocarpine, and salts, 1709².
- C₁₁H₁₇N₂O₄ Barbituric acid, 5-allyl-5-butyl-, 2641².
- , 5-allyl-5-sec-butyl-, 2641².
- , 5-allyl-5-isobutyl-, 2641².
- 2-Pyrrolicarboxylic acid, 5-ethyl-4-formyl-3-methyl-, Et ester, oxime, 1429².
- C₁₁H₁₇N₂O₄ Hydrazine, α -isopropyl- β -phenyl-, oxalate, 642².
- Pyridazine, N, N' - dicarboxyendomethylenetetrahydro-, 2499².
- C₁₁H₁₇N₂O₄ Cyclohexanenitrile, 1-allyl-2-keto-, semicarbazone, 1262².
- C₁₁H₁₇N₂O₄ 3 - Pyrrolicarboxylic acid, 2 - formyl-, 4,5 - dimethyl-, Et ester, semicarbazone, 3270².
- C₁₁H₁₇O₄ Benzyl alcohol, α,α -diethyl-, 358².
- Δ^1 - 2 - Bicyclo[2.2.2]octenone, 1,3,3 - trimethyl-, 3087².
- α -Cregol, 5-*tert*-butyl-, 43¹.
- Ether, benzyl butyl, 2194¹.
- , benzyl isobutyl, 2194¹.
- 3-Pentanol, 1-phenyl-, 2330².
- C₁₁H₁₇O₄ Benzyl alcohol, α,α -diethyl α -hydroxy-, 359².
- 2-Butanol, 4-*p*-anisyl-, 58².
- Guaiacol, 4-butyl-, 2943².
- Propionic acid, (β -cyclohexylethyl), 3476².
- C₁₁H₁₇O₄S Sulfone, butyl β -tolyl, 1850².
- C₁₁H₁₇O₄S Benzaldehyde, bis(β -hydroxyethyl)mercaptal, 1557².
- C₁₁H₁₇O₄S Camphocarboxylic acid, 1702².
- Guaiacol, 4-(γ -hydroxybutyl)-, 2943².
- C₁₁H₁₇O₄S Sulfone, benzyl (β -ethoxyethyl), 1557².
- p*-Toluenesulfonic acid, Bu ester, 977^{1,4}.
- 1850², isobutyl ester, 977¹.
- C₁₁H₁₇O₄ Acetate of lactone from *Alstonia* bark, 2959².
- Cyclohexanemalononic acid, 2 hydroxy-, lactone, Et ester, 2644².
- α -Veratraldehyde, di Me acetal, 2668².
- C₁₁H₁₇O₄ Malonic acid, bis(formylmethyl), di-Et ester, 1829².
- C₁₁H₁₇O₄ 1,1,2,3 - Propanetetracarboxylic acid, tetra- Me ester, 246².
- C₁₁H₁₇S Sulfide, butyl β -tolyl, 1850².
- C₁₁H₁₇BrO Ether, bu, 115 20², made from chena podium oil, 292².
- C₁₁H₁₇BrO α - Campholenic acid, α -bromo-, Me ester, 487².
- C₁₁H₁₇N₂ Aniline, N-amyl-, 475².
- , N-isourmyls, 2614¹.
- Benzylamine, N, N-diethyl-, 1530².
- α -Toluidine, 5-*tert*-butyl-, 43¹.
- C₁₁H₁₇NO₂ Cyclopentanecarboxylic acid, 3-cyano - 1,2,2 - trimethyl-, Me ester, 1703².
- Phenethylamine, ethoxymethoxy-, and nitrate, 2959².
- 3 - Pyrrolicarboxylic acid, 1,2,4,5-tetramethyl-, Et ester, 1429².
- C₁₁H₁₇NO₂S 2 - Thiopropenecarboxylic acid, β -diethylaminoethyl ester, -HCl, 653².
- C₁₁H₁₇NO₂ Benzylamine, 3,4,5-trimethoxy-methyl-, and -HCl, 2632².
- Mescaline, 2109¹.
- Pyromelic acid, β -diethylaminoethyl ester, -HCl, 653².
- C₁₁H₁₇NO₂S Benzenesulfonamide, 2(or 5)-butyl-5(or 2)-methoxy-, 266².
- C₁₁H₁₇N₂O₂ Verbanone, 3-epoxy-, semicarbazone, 52².
- C₁₁H₁₇N₂O₂ 3 - Pyrrolicarboxylic acid, 1 - carbamido - 2,4,5 - trimethyl-, Et ester, 1420².
- C₁₁H₁₇ Camphane, methylene-, 1264².
- Camphene, 1-methyl-, 260².
- Homoverbanene, 53².
- Pentene, cyclohexyl-, 966², 3470².
- Tricyclo[2.2.1.0^{2,5}]heptane, tetramethyl-, 269².
- C₁₁H₁₇BrNO₂ 1 - Piperidinepropionic acid, α -(γ -bromo - β -hydroxypropyl), lactone, -HBr, 3084².
- 1,1' - Spirohipiperidine - 3 - carboxylic acid, α - N - bromo - 5 - hydroxy-, lactone, 3084².
- C₁₁H₁₇Br₂ 1,16 - Hendecadigonal, 2,10 - dibromo-, 643¹.
- C₁₁H₁₇Cl₂O₂Te 1,2 - Telluropyran - 3,5(4,6)-dione, 2 - heptyl-, 1,1 - dichloride, 2027².
- C₁₁H₁₇Cl₂CrNO₂ 1385².
- C₁₁H₁₇N₂ Cyclohexanone, azide with cyclopentanone, 2343².
- Ethylamine, ' β,β ' - 5 - m - tolylenebis-, 1561².
- C₁₁H₁₇N₂O₂ 2 - Pyrrolicarboxylic acid, β - diethylaminoethyl ester, and -HCl, 653².
- C₁₁H₁₇N₂O₂ Barbituric acid, 5-ethyl 5-isoxymyl-, P 78².
- C₁₁H₁₇N₂O₂S Aniline - 2 - thioisulfonic acid, 1-amino 4-diethyl-, Me ester, 513².
- C₁₁H₁₇N₂O₂ Piperazine, N, N' - dicarboxyendomethylene-, 2499².
- C₁₁H₁₇N₂O₂ Cyclohexanenitrile, 2 - keto - 1 - propyl-, semicarbazone, 1262².
- C₁₁H₁₇O₂ Borneol, formate, 2657².
- 2-Camphocarboxylic acid, 264².
- Δ^1 - Cyclohexanecarboxylic acid, 3 methyl-, Et ester, 2630².
- Δ^2 - Cyclohexenecarboxylic acid, 2,2,4-trimethyl-, Me ester, 2650².
- Fenchyl alcohol, formate, 2657².
- Isoborneol, formate, 2657².
- C₁₁H₁₇O₂Te 1,2 - Telluropyran - 3,5(4,6)-dione, 2 heptyl-, 2027².
- C₁₁H₁₇O₂ 2 - Furaldehyde, diisopropylacetal, 1694².
- C₁₁H₁₇O₂ 1,1 - Cycloheptanediacetic acid, 1802².
- Cyclohexanecarboxylic acid, 2 carboxy-, 261², 1270².
- Cyclohexanepropionic acid, 2 - (carboxymethyl)-, 824².
- C₁₁H₁₇O₂ Glutaric acid, α -keto- β,β -dimethyl-, di-Et ester, 2325².
- Malonic acid, β -vinyl-oxyethyl-, di-Et ester, 1413².
- C₁₁H₁₇O₂ 1,1 - Cycloheptanediacetic acid, α,α -dihydroxy-, and Ag salt, 2934².
- C₁₁H₁₇As₂NO₂ Benzenearsonic acid, 3-formamido - 4 - hydroxy-, ethylamine salt, P 1327².
- C₁₁H₁₇Cl₂O₂ 1,2 - Pyridazinedicarboxylic acid, 3 - chlorohexahydro - 6 - methyl-, di-Et ester, 2499².
- C₁₁H₁₇Cl₂O₂ Malonic acid, (β -chloroethyl)ethyl-, di-Et ester, 1560².
- C₁₁H₁₇Cl₂O₂Te 4 - Ethenoxy - 2 - keto - 1,1 - di-methyl-, Δ^2 - isooheptyltellurium tri-chloride, 2027².
- C₁₁H₁₇NO Menthone, oxime, 3369², 3367¹.

- C₁₁H₁₁NOS Carbamic acid, thiono-, bornyl ester, 572.
- C₁₁H₁₁NO₂ Valeric acid, γ hydroxy- α -(1-piperidyl)methyl-, lactone, -HBr, 3084².
- C₁₁H₁₁NO₂ Cyclohexanecarboxylic acid, 3-keto-2,2,4-trimethyl-, Me ester, oxime, 2656¹.
- C₁₁H₁₁N₂O Isobornylone, semicarbazone, 2697.
- Δ^2 -5- α -Menthonone, semicarbazone, 532.
- 1(2)-Naphthalenone, octahydro-, semicarbazone, 1270¹.
- 2-Pentanone, 3- Δ^1 -cyclopentenyl-, semicarbazone, 2032².
- Piperitone semicarbazone, m. 217°, 2727².
- Verbanone, semicarbazone, 532.
- C₁₁H₁₁N₂O₂ Semicarbazone of a keto alc (?) from chenopodium oil, 2942⁷.
- C₁₁H₁₁N₂O₂ Malonic acid, acetyl-, di-Et ester, semicarbazone, 3480⁶.
- Sebacic acid, δ keto-, semicarbazone, 1270².
- C₁₁H₁₁N₂O₂ 3-Tributyl-, hexahydro-1,3,5-trimethyl-, uric acid salt, 538⁹.
- C₁₁H₁₁Br₂CoHgN₂O₄ + H₂O, 910⁸.
- C₁₁H₁₁ClCoN₂O₄ + 2H₂O, 940⁸.
- C₁₁H₁₁ClCoHgN₂O₄ + H₂O, 940⁸.
- C₁₁H₁₁CoHgIN₂O₄ + H₂O, 940⁸.
- C₁₁H₁₁CoN₂O₄ + 3H₂O, 940⁸.
- C₁₁H₁₁N₂ Camphor, 6-methyl-, hydrazone, 2697.
- C₁₁H₁₁N₂O₂ Hydantoin, 5,5-diisobutyl-, 376¹.
- C₁₁H₁₁O₂ Camphancarbinol, 1264¹.
- Verbanol, methyl-, 532.
- C₁₁H₁₁O₂ Butyric acid, α -vinylmethyl ester, 2331.
- Cyclohexanecarboxylic acid, 3-methyl-, Et ester, 2030¹.
- Cyclohexanopropanol, acetate, 2040⁶.
- Δ^2 -2-Heptenol, 2-ethyl-, acetate, 1852².
- Undecylenic acid, 1851².
- C₁₁H₁₁O₂ Caproic acid, α -acetyl- α -methyl-, Et ester, 247¹.
- Caprylic acid, η -formyl-, Et ester, 168¹.
- Cyclohexanecarboxylic acid, 1-hydroxy-3-methyl-, Et ester, 2030¹.
- α -hydroxy-, Pr ester, 982⁴.
- Cyclohexanecarboxylic acid, 3-hydroxy-2,2,4-trimethyl-, Me ester, 2656¹.
- 2-Furancarbinol, α -butyltetrahydro-, acetate, 1561¹.
- Pelargonaldehyde, θ -hydroxy-, acetate, 468¹.
- C₁₁H₁₁O₂ Archaic acid, di-Me ester, *see* *acid comid*, 50⁶.
- Glutaric acid, β , β -dipropyl-, 1802¹.
- Malonic acid, butyl-, di-Et ester, 2641¹.
- γ -butyl-, di-Et ester, 2641¹.
- γ -isobutyl-, di-Et ester, 2641¹.
- C₁₁H₁₁O₂ Acetic acid, trimethylendithiois-, di-Et ester, 1407¹.
- C₁₁H₁₁O₂ Heptaoxymethylene, diacetate, 1245².
- Primeverose, 2168¹, 2511¹.
- C₁₁H₁₁ClCoN₂O₄ + 3H₂O, 940⁸.
- C₁₁H₁₁CoN₂O₄, 940⁸.
- C₁₁H₁₁NO₂ Eranthamide, N,N-diethyl-, δ -keto-, 2176¹.
- C₁₁H₁₁N₂O₂ 5- α -Menthonone, semicarbazone, 532.
- C₁₁H₁₁N₂O₂ Alanine, [N-N'-bis(allyl)], 2503¹.
- C₁₁H₁₁O₂ 2-Hendecanone, 2546².
- 2-Heptanone, 3-butyl-, 1244².
- C₁₁H₁₁O₂ Undecylic acid, 1475¹, 1695².
- C₁₁H₁₁O₂ Galactoside, tetramethylmethyl-, 974¹.
- C₁₁H₁₁N₂O₂ Carbamic acid, butoxybutyl-, Et ester, 2186¹.
- C₁₁H₁₁N₂O₂ Semicarbazide, 4-menthyl-, and HCl, 1130¹.
- C₁₁H₁₁ Hendecane, 1244¹.
- Nonane, 5-ethyl-, 1244¹.
- C₁₁H₁₁O₂ 6-Hendecanol, 1244¹, 1282¹.
- 2-Heptanol, 3-butyl-, 1244¹.
- Nonanol, dimethyl-, 1718¹.
- C₁₁H₁₁O₂ Formaldehyde, diethyl-, acetal, 464¹, 1992¹.
- 1,9-Hendecanediol, 469¹.
- Pelargonaldehyde, di-Me acetal, 468¹.
- C₁₁H₁₁O₂ Pelargonaldehyde, θ -hydroxy-, di-Me acetal, 468¹.
- C₁₁H₁₁O₄ Pyruvaldehyde, tetra-Et acetal, 248².
- C₁₁H₁₁Br₂ClCoN₂O₄, 677⁸.
- C₁₁H₁₁ClCoN₂O₄, 677⁸.
- C₁₁H₁₁ClCoN₂O₄, 677⁸.
- C₁₁H₁₁ClCoN₂O₄, 677⁸.
- C₁₁H₁₁ClCoN₂O₄, 677⁸.
- C₁₁H₁₁ClCoN₂O₄ + H₂O, 677⁸.
- C₁₁H₁₁N₂O₁₂Th + 4H₂O, 2175².
- C₁₁H₁₁N₂O₁₂ + 24H₂O, 2609⁸.
- C₁₁H₁₁Fe₂K₂N₂O₁₂ + 24H₂O, 2609⁸.
- C₁₁H₁₁Fe₂O₁₂, 2609⁸.
- C₁₁H₁₁N₂O₁₂ Picryl sulfide, 1561¹, 2483².
- C₁₁H₁₁N₂O₁₂ Disulfide, hexanitrodiphenyl(?), 1561¹.
- C₁₁H₁₁N₂O₂ Diphenylquinone, tetratriazo-, 644¹.
- C₁₁H₁₁Br₂N₂O₂ 4-Quinazolinol, bromo-, 1282⁸.
- C₁₁H₁₁Br₂N₂O₂ 3-Isophenoxazone, 4-amino-5,7,9-tribromo-, 2340⁴.
- C₁₁H₁₁Br₂O₂ 2(1)- α -Naphthofuranone, 1,1,4-tribromo-, 2047².
- C₁₁H₁₁Cl₂N₂O₂ 2,1- β -Pyridoquinazol-11-one, trichloro-, 1282².
- C₁₁H₁₁Cl₂N₂O₂ 3-Isophenoxazone, 4-amino-5,7,9-tribromo-, 2340⁴.
- C₁₁H₁₁N₂O₂ Diphenylamine, hexanitro-, 3258².
- C₁₁H₁₁BrClO₂ Pyrocatecholboric acid, 4-chloro-, 3430⁸.
- C₁₁H₁₁BrN₂O₂ Dinitropyrocatechol boric acid, K salt, 2178¹.
- C₁₁H₁₁BrN₂O₂ Pyrocatecholboric acid, 3-nitro-, 3440⁸.
- C₁₁H₁₁Br₂Cl₂O₂ Benzenesulfonic acid, 2,5-dibromothiol-, 2,5-dichlorophenyl ester, (2), 1133⁴.
- 2,5-dichlorothiol-, 2,5-dibromophenyl ester, (2), 1133⁴.
- Di-sulfoxide, 2,5-dibromophenyl 2,5-dichlorophenyl(?), 1133⁴.
- C₁₁H₁₁Br₂O₂ 1(2)- β -Naphthofuranone, 2,3-dibromo-, 2047².
- C₁₁H₁₁Cl₂N₂O₂ Disulfide, bis(4-chloro-2-nitrophenyl), 1113¹.
- C₁₁H₁₁Cl₂O₂ Naphthalyl chloride, 497¹.
- C₁₁H₁₁Cl₂N₂ Naphthylamine, trichloro-, P 300¹.
- C₁₁H₁₁Cl₂N₂O₂ Indophenol, 2,3',5'-trichloro-, 2038¹.
- C₁₁H₁₁N₂NaO₂ 1(2)- β -Naphthofuranone, 2-nitro-, Na deriv., 2048².
- C₁₁H₁₁O₂ Acenaphthenequinone, 829¹.
- C₁₁H₁₁O₂ Naphthalic anhydride, 2196².
- C₁₁H₁₁O₂ 1,9-Benzodi-1,4-pyran-4,6-dione, 517¹.
- Naphthalic anhydride, 2-hydroxy-, 275¹.
- 1,2- β -Naphthofurandione, 7-hydroxy-, 828¹.
- C₁₁H₁₁O₂ Mellitic acid, 2195¹.
- C₁₁H₁₁Br₂N₂O₂ 2,1- β -Pyridoquinazol-11-one, bromo-, 1282⁸.
- C₁₁H₁₁Br₂N₂O₂ 3-Isophenoxazone, 4-amino-9-bromo-, 2340⁴.
- C₁₁H₁₁Br₂O₂ 1(2)- β -Naphthofuranone, 2-bromo-, 2047².
- C₁₁H₁₁Br₂N₂O₂ Phenol, dibromonitro-4-phenyl(?), 1358¹.

- $C_{12}H_8Br_2N_2O$ 2,1,3 - Benzotriazole, 2 - (3,5-dibromo - 4 - hydroxyphenyl)-, 514⁴.
 $C_{12}H_8Br_2N_2O$ 2,1,3 - Benzotriazole, 2 - (dibromo - 2,4 - dihydroxyphenyl)-, 514⁴.
 $C_{12}H_8Br_2N_2O$ 2,1,3 - Benzotriazole, 2 - (dibromo - 2,4 - dihydroxyphenyl)-, picrate, 258⁸.
 $C_{12}H_8ClN_2O_2$ 3 - Isophenoxazone, 4 - amino-9-chloro-, 2340⁴.
 $C_{12}H_8Cl_2N_2O$ Indophenol, 3',5'-dichloro-, 3038⁴.
 $C_{12}H_8CNO_2S$ Benzenesulfonic acid, 2,5-dimethyl-, o-nitrophenyl ester (?), 1133⁴.
 —, o-nitrothiol-, 2,5 - dichlorophenyl ester (?), 1133⁴.
 Disulfide, 2,5 - dichlorophenyl o - nitrophenyl(?), 1133⁴.
 $C_{12}H_8Cl_2N_2O$ 2,1,3 - Benzotriazole, 2 - (3,5-dichloro - 4 - hydroxyphenyl)-, 514⁴.
 $C_{12}H_8HgN_2O$ Benzene, 1,3,5 - trinitro - 2-phenylmercuri-, 2483⁴.
 $C_{12}H_8N_2O$ 2,1,3 - Benzotriazole, 2 - (2,4 - dihydroxydinitrophenyl)-, salts, 514⁴.
 $C_{12}H_8N_2O_2$ Diphenylamine, tetranitro-, 3258².
 $C_{12}H_8$ Acenaphthylene, 829⁴.
 $C_{12}H_8AsCl$ Arsenious chloride, o,o'-diphenylene-, 1132⁷.
 $C_{12}H_8AsClO$ Phenoxarsine, 6-chloro-, 1699⁴.
 $C_{12}H_8AsI$ Arsenious iodide, o,o'-diphenylene-, 1132⁷.
 $C_{12}H_8BKO_4$ Dipyrocatecholboric acid, K salt, 2178⁴.
 $C_{12}H_8BNaO_4$ Dipyrocatecholboric acid, Na salt, 2178⁴.
 $C_{12}H_8BiNaO_4 + H_2O$ 2310⁴.
 $C_{12}H_8BrN_2O$ Indophenol, 3-bromo-4-phenyl-(?), 1858⁴.
 $C_{12}H_8BrN_2O$ Diphenylamine, p-bromo-p'-nitro-N-nitroso-, 1561¹⁰.
 $C_{12}H_8BrN_2O$ Diphenylamine, 2-bromo-4,6-dinitro-, 981¹.
 $C_{12}H_8BrN_2O$ Azoxybenzene, p,p' - dibromo-, 978⁴.
 $C_{12}H_8BrN_2O_2$ Aniline, dibromo-, picrate, 258⁸.
 $C_{12}H_8BrO$ Phenol, dibromo-4-phenyl-(?), 1858⁴.
 $C_{12}H_8ClN_2O$ Indophenol, 2-chloro-, 2038⁴.
 $C_{12}H_8ClNO_2S$ Benzenesulfonic acid, p-chlorothio-, o-nitrophenyl ester (?), 1133⁴.
 Disulfide, p - chlorophenyl o - nitrophenyl (?), 1133⁴.
 $C_{12}H_8ClN_2O$ 4 - Anilino - 3,5 - dinitrobenzenediazonium chloride, 2824⁴.
 $C_{12}H_8Cl_2N_2$ 4,4' - Bi[benzenediazonium chloride], $PbCl_2$ double salt, 476⁷.
 $C_{12}H_8Cl_2N_2O$ Aniline, tetrachloro-, picrate, 258⁸.
 $C_{12}H_8Cl_2O_2S$ Acenaphthenedisulfonyl chloride, 274⁴.
 $C_{12}H_8Cl_2N_2$ 4,4' - Bi[benzenediazonium tetra-chloriodide], 476⁷.
 $C_{12}H_8INO_2$ Acenaphthene, iodonitro-, 651⁷.
 $C_{12}H_8N_2$ Phenazine, 989⁴.
 Phenazone, ferri- and ferrocyanides, 2837⁴.
 $C_{12}H_8N_2O$ Isophenoxazine, 3-amino-, and p-chlorate, 1857⁴.
 Phenazine, 5-oxide, 989⁴.
 2-Phenazolinol, 643⁴.
 1,10 - Pyridoquinol - 5(fu) - one(?), 1282⁴.
 2,1 - β - Pyridoquinazol - 11 - one, and salts, 1282⁴.
 $C_{12}H_8N_2O$ Isonicotinic anhydride, 2954⁴.
 Nicotinic anhydride, 2954⁴.
 Picolinic anhydride, 2954⁴.
 Quinone, 2-phenylazo-, 61³.
 $C_{12}H_8N_2O_2$ Diselenide, bis(o - nitrophenyl)-, 1862⁴.
 $C_{12}H_8N_2O_2S$ Sulfone, bis(m - nitrophenyl), 980⁴.
- $C_{12}H_8N_2O$ Nicotinic acid, 2-amino-, bimolecular cyclic anhydride, 72⁴, 518⁴.
 $C_{12}H_8N_2O_2$ 4 - Anilino - 3,5 - dinitrobenzenediazonium nitrate, 2824⁴.
 $C_{12}H_8O$ 7-Acenaphthenone, 821⁴.
 $C_{12}H_8O$ 1(2) - β - Naphthothiophenone, 777⁴.
 $C_{12}H_8O_2$ 1,2 - Naphthalenedicarboxylic anhydride, 3,4 - dihydro-, 1269⁴.
 $C_{12}H_8O_2$ 2 - Naphthaleneglyoxylic acid, 1-hydroxy-, 2047⁴.
 Naphthalic acid, 829⁴.
 $C_{12}H_8O_2$ Naphthalic acid, 2-hydroxy-, 275⁴.
 $C_{12}H_8O_2S$ Naphthalic acid, 2-sulfo-, and salts, 274⁴.
 $C_{12}H_8AsCl_2$ Arsenic, dichloro(o - phenylphenyl)-, 1132⁷.
 $C_{12}H_8AsCl_2O$ Ether, (o - dichloroarsylphenyl) phenyl, 1699⁴.
 $C_{12}H_8AsO$ Biphenyl, o-arsino-, 1132⁷.
 $C_{12}H_8AsO_2$ Arsinic acid, o,o'-diphenylene-, 1132⁷.
 $C_{12}H_8AsO_4 + 4H_2O$ 2310⁴.
 $C_{12}H_8BO_4$ Dipyrocatecholboric acid, 1386⁷, 2178⁴.
 $C_{12}H_8BO_4$ Dipyrogallolboric acid, 2178⁴.
 $C_{12}H_8BrN_2O$ Diphenylamine, p-bromo-p'-nitro-, 1561¹⁰.
 $C_{12}H_8BrN_2O$ Acetamide, N - (4 - bromo - 3-nitro - 1 - naphthyl)-, 2201¹.
 $C_{12}H_8BrN_2O_2S$ Benzenesulfonanilide, p' - bromo-m-nitro-, 642².
 $C_{12}H_8BrN_2O$ Aniline, bromo-, picrate, 258⁸.
 $C_{12}H_8BrO$ Acetyl bromide, naphthoxy-, 2047⁴.
 $C_{12}H_8BrO$ Umbelliferone, 3 bromo-, Et bi-carbonate, 2665⁴.
 $C_{12}H_8ClN_2O$ Acetamide, N - (4 - chloro - 3-nitro - 1 - naphthyl)-, 2201¹.
 $C_{12}H_8ClN_2O_2S$ Benzenesulfonanilide, o'(and p')-chloro-m-nitro-, 642².
 $C_{12}H_8ClNO$ Aniline, chloro-, picrate, 258⁸.
 $C_{12}H_8ClO_2S$ Acenaphthenesulfonyl chloride, 274⁴.
 $C_{12}H_8Cl_2NO$ 1 - Naphthylamine, dichloroacetate, 1557⁷.
 $C_{12}H_8Cl_2NO$ Phenol, 2,6 - dichloro - 4 - p-hydroxyanilino-, 2038⁴.
 $C_{12}H_8Cl_2NO_2$ 2 - Naphthalenesulfonic acid, 4-(3,5 - dichloro - 4 - hydroxyphenylimino)-1,2 - dihydro - 1 - keto-, 2038⁴.
 $C_{12}H_8Cl_2O$ Addn. compd. of pyrocatechol and trichloroacetic acid, 3200¹.
 $C_{12}H_8IN_2O$ Pyridine, 5 - iodo - 2 - methoxy-, picrate, 1424⁴.
 $C_{12}H_8N$ (See also Carbazole.)
 2,3,7 - Indenopyridine, 494⁴.
 $C_{12}H_8NO$ Phenoxazines, 989⁴.
 $C_{12}H_8NO$ Acenaphthene, 1-nitro-, 3208⁴.
 Indophenol, 1133⁴.
 Isonicotinic acid, Ph ester, and HCl , 2954⁴.
 Nicotinic acid, Ph ester, 2954⁴.
 Picolinic acid, Ph ester, 2954⁴.
 $C_{12}H_8NO_2$ Phenol, 2-nitro-4-phenyl-, 1858⁴.
 o - Toluic acid, α - hydroxy - α - (1,2 - pyrrolylene)(?), and salts, 2951¹.
 $C_{12}H_8NO$ Acetic acid, anil, 3255⁴, 3256⁴.
 $C_{12}H_8NO_2S$ Acenaphthedisulfonic acid, nitro-, Na salt, 275⁴.
 $C_{12}H_8N_2$ Phenazine, amino-, 644⁴, 1857⁴.
 $C_{12}H_8N_2O$ 2,1,3 - Benzotriazole, 2 - (p - hydroxyphenyl)-, 514⁴.
 $C_{12}H_8N_2O$ Acenaphthene, o-nitro-, 3192⁴.
 2,1,3 - Benzotriazole, 2 - (2,4 - dihydroxyphenyl)-, 514⁴.

- $C_{12}H_{11}N_2O_2$ Benzamide, *N* - nitro - *N'* - 4 - pyridyl-, 70².
Diphenylamine, *o*-nitro-*p'*-nitroso-, 2191¹, 2192².
Phenyl, *p* - (*o* - nitrophenylazo)-, 514².
Quinoxaline, *N* - (*o* - nitrophenyl)-, oxime, 2191¹.
- $C_{12}H_{11}N_2O_4$ Diphenylamine, dinitro-, 3258¹.
Resorcinol, 4 - (*o* - nitrophenylazo)-, and *Ba* salt, 514².
- $C_{12}H_{11}N_2O_4$ Hydroquinol, 2 - nitro - 6 - phenylazoxy-, 44¹.
- $C_{12}H_{11}N_2S_2$ 1,3,4 - Thiodiazole - 2 - mercaptan, 4,5 - dihydro - 5 - (1 - naphthylimino)-, 988².
- $C_{12}H_{11}N_4$ Azobenzene, 4-triazo-, 644².
- $C_{12}H_{11}N_4O_2S_2$ 4 - Anilino - 3,5 - dinitrobenzene-diazonium sulfate, 2824².
- $C_{12}H_{11}N_4$ See *Acenaphthene*; *Biphenyl*.
- $C_{12}H_{11}N_4NO_2$ Phenazarsinic acid, and salts, 278².
- $C_{12}H_{11}N_4AsNO_4$ Arsinic acid, (*o* - nitrophenyl)-phenyl-, 257².
- $C_{12}H_{11}N_4B_2O_5$ Di(nitropyrocatechol)-boric acid, *NH*₄ salt, 2178².
- $C_{12}H_{11}N_4BaNO_4 + 3H_2O$ Hydroxylamine, β - nitroso - β - phenyl-, *Ba* salt, 1233².
- $C_{12}H_{11}N_4BeCl_2NO_4$, 3071¹.
- $C_{12}H_{11}N_4SeO_4$, 3071¹.
- $C_{12}H_{11}N_4BrNO_2$ 2,1 - Naphthoquinotrole, 6 - bromo-1-ethyl-, 59².
- $C_{12}H_{11}N_4BrNO_2S_2$ 1,3,4 - Thiodiazole - 2 - mercaptan, 4 - acetyl - 5 - (*p* - bromophenylimino) - 4,5 - dihydro-, acetyl deriv., 988².
- $C_{12}H_{11}N_4Br_2O_2$ 2(1) - Naphthalenone, 1,6 - dibromo-1-ethyl-, 59².
- $C_{12}H_{11}N_4CaNO_4 + 2H_2O$ Hydroxylamine, β - nitroso - β - phenyl-, *Ca* salt, 1233².
- $C_{12}H_{11}N_4CdNO_4$ Hydroxylamine, β - nitroso- β -phenyl-, *Cd* salt, 1232².
- $C_{12}H_{11}N_4Cl_2Hg$ Aniline, 2,2' - mercuribis[4-chloro-, 50²].
- $C_{12}H_{11}N_4Cl_2Si$ Silicane, dichlorodiphenyl-, 981¹.
- $C_{12}H_{11}N_4CoNO_4$ Hydroxylamine, β - nitroso- β -phenyl-, *Co* salt, 1233².
- $C_{12}H_{11}N_4CuNO_4$, 2173¹.
- $C_{12}H_{11}N_4FTI$ Diphenylthallic fluoride, 1232².
- $C_{12}H_{11}N_4HgNO_4$ Hydroxylamine, β - nitroso- β -phenyl-, *Hg* salt, 1232².
- $C_{12}H_{11}N_4HgNO_4S_2$ Benzenesulfonic acid, *p*-[hydroxybis(hydroxymercuri)phenylazo]-, and *di-Na* salt, 2482².
- $C_{12}H_{11}N_4HgNO_4S_2$ Benzenesulfonic acid, *p*-[2,4-dihydroxy - 3,5 - bis(hydroxymercuri)phenylazo]-, *K* salt, 2482².
- $C_{12}H_{11}N_4HgNO_4$ Hydroxylamine, β - nitroso- β -phenyl-, *Hg* salt, 1232².
- $C_{12}H_{11}N_4MoNO_4$ Hydroxylamine, β - nitroso- β -phenyl-, *Mo* oxide compd., 1232².
- $C_{12}H_{11}N_4$ Azobenzene, 1703², 2936¹, 3406².
Carbazole, 1-amino-, 282².
Isopyridindole, methyl-, 507², 2956².
Phenazine, 8,10-dihydro-, 989².
- $C_{12}H_{11}N_4O^+$ Asoxybenzene, 2927².
Benzamide, *N*-4-pyridyl-, 70².
3 - Indoletrile, 1 - acetyl - 2 - methyl-, 501¹.
Phenol, *p*-phenylazo-, 2616².
- $C_{12}H_{11}N_4NO_4$ Anthranilic acid, *N* - 2 - pyridyl-, *Na* salt, 1232².
p-Azophenol, 2065².
Hydroquinol, 2-phenylazo-, 43².
- 2 - Indolecarboxylic acid, 6 - cyano-, *Et* ester, 506¹.
Pyridine, 2(and 4) - *p* - nitrobenzyl-, 2498¹.
- $C_{12}H_{11}N_4O_2$ 2 - Furancarboxylic acid, 3 - formyl-, phenylhydrazine, 1139².
Hydroquinol, 2-phenylazoxy-, 43².
- $C_{12}H_{11}N_4NO_4$ Acetamide, *N* - (4 - hydroxy - 3-nitro - 1 - naphthyl)-, 22014¹.
- $C_{12}H_{11}N_4NO_4$ Pyruvic acid, (4 - cyano - 2 - nitrophenyl)-, *Et* ester, 506¹.
- $C_{12}H_{11}N_4S_2$ Trisulfide, bis(*p* - aminophenyl)-, and *HCl*, 1413².
- $C_{12}H_{11}N_4$ Benzotriazole, 7-amino-1-phenyl-, 282².
—, 2-(*p*-aminophenyl)-, 514².
Phenazine, 1,3 - diamino-, and perchlorate, 644².
- $C_{12}H_{11}N_4MIO_4$ Hydroxylamine, β - nitroso- β -phenyl-, *Ni* salt, 1233².
- $C_{12}H_{11}N_4NO_2$ 2,1,3 - Benzotriazole, 2 - (*p* - aminophenyl)-, 1-oxide, 514².
—, 2 - (5 - aminosalicyl)-, 514².
- $C_{12}H_{11}N_4NO_4$ Aniline, *p* - (*o* - nitrophenylazo)-, 514².
Oxamide, *N*, *N'* - di - 2 - pyridyl-, 70².
- $C_{12}H_{11}N_4NO_4$ *p* - Phenylenediamine, 2,6 - dinitro-*N*-phenyl-, 2824².
- $C_{12}H_{11}N_4NO_4Pb$ Hydroxylamine, β - nitroso- β -phenyl-, *Pb* salt, 1232².
- $C_{12}H_{11}N_4NO_4Sn$ Hydroxylamine, β - nitroso- β -phenyl-, *Sn* salt, 1232².
- $C_{12}H_{11}N_4NO_4Sr + 2H_2O$ Hydroxylamine, β - nitroso - β - phenyl-, *Sr* salt, 1233².
- $C_{12}H_{11}N_4NO_4Zn$ Hydroxylamine, β -nitroso- β -phenyl-, *Zn* salt, 1233².
- $C_{12}H_{11}O$ Phenyl ether, 1361², 2903².
- $C_{12}H_{11}O_2S$ Sulfoxide, diphenyl-, 3488².
- $C_{12}H_{11}O_2$ 2-Naphthoic acid, 1-methyl-, 1269².
Resorcinol, 2-phenyl-, 2334².
- $C_{12}H_{11}O_2S$ Phenyl sulfone, 2557², 3488².
- $C_{12}H_{11}O_2Se$ Acetic acid, (1-naphthylsenyl)-, 3260².
- $C_{12}H_{11}O_2$ 2 - Indancarboxylic acid, 2 - (β - hydroxyethyl) - 1 - keto-, γ - lactone, 61².
1,2 - Naphthalenedicarboxylic anhydride, 1,2,3,4 - tetrahydro-, 126².
1 - Naphthoic acid, 5-methoxy-, 495².
 α,γ - Pentadienaldehyde, δ - hydroxy-, benzoate, 517².
- Pyromucic acid, benzyl ester, 653¹.
- $C_{12}H_{11}O_2S$ 1 - Acenaphthenesulfonic acid, 274².
- $C_{12}H_{11}O_4$ 1,2 - Benzopyran - 4 - acetic acid, 2-keto-7-methyl-, 2485².
- Malonic acid, cinnamal-, 2475².
1,2 - Naphthalenedicarboxylic acid, 3,4-dihydro-, and *Ag* salt, 1269².
- Quinhydrone, 208², 247², 927², 2314¹.
- $C_{12}H_{11}O_4$ 2,5 - Benzofurandiol, diacetate, 1321².
2,3² - Furandicarboxylic acid, 2,3 - dihydro-5-phenyl-, 246².
Umbelliferone, *Et* bicarbonate, 2665².
- $C_{12}H_{11}O_4$ 3,4 - Furandicarboxylic acid, tetrahydro - 2 - keto - 5 - phenyl-, 2643².
- $C_{12}H_{11}O_4M_2$ Acenaphthenedisulfonic acid, and salts, 274², 275¹.
Peroxide, bis(phenylsulfonyl), 980².
- $C_{12}H_{11}AsO_4$ Arsinic acid, diphenyl-, 478².
- $C_{12}H_{11}AsO_4$ Benzenearsonic acid, *o*-phenyl-, 1132².
- $C_{12}H_{11}AsO_4$ Benzenearsonic acid, *o*-phenoxy-, 1699².
- $C_{12}H_{11}BrO_2$ 2(1) - Naphthalenone, 1 - bromo-1-ethyl-, 59².
2 - Naphthol, 6 - bromo - 1 - ethyl-, 59².
- $C_{12}H_{11}BrO_4$ 1,2 - Cyclopropanedicarboxylic acid

- 1 - bromo - 3 - phenyl -, mono-Me ester, 2643⁷.
- C₁₂H₁₁BrN₃O₂ 1,2,3 - Triazole - 4 - carboxylic acid, 1 - (2,4 - dibromophenyl) - 5 - methyl-, Et ester, 476⁹.
- C₁₂H₁₁ClN₃O₃ Thiophosphate anilide chloride, Ph ester, 2325².
- C₁₂H₁₁ClO₂ Acetophenone, α - chloro - 2,4² - dihydroxy-, diacetate, 2601¹.
- C₁₂H₁₁ClN₃O₂ 1,2,3 - Triazole - 4 - carboxylic acid, 1 - (2,4 - dichlorophenyl) - 5 - methyl-, Et ester, 476⁹.
- C₁₂H₁₁IN₃O 4 - Cyano - 7 - methoxy - 1 - methyl-quinolinium iodide, 2934¹.
- C₁₂H₁₁IO Ether, ethyl 4-iodo-1-naphthyl, 2948⁸.
- C₁₂H₁₁N (See also *Diphenylamine*.)
Acenaphthenamine, 651⁷; and -HCl, 3268⁸.
- C₁₂H₁₁NO Ketone, benzyl 2-pyrryl, 2492⁸.
- Phenol, 2 - amino - 4 - phenyl-, and -HCl, 1858⁸.
- Quinoline, 2-allyloxy-, 68⁹.
- 2(1) - Quinolone, 1 - allyl-, and chloroplatinate, 69¹.
- C₁₂H₁₁NOS Benzenesulfonanilide, 257¹.
- C₁₂H₁₁NO₂, 1980⁹.
- Acetamide, N - (5 - hydroxy - 2 - naphthyl)-, 2337⁷.
- Eisholtzanilide, 1130⁴.
- C₁₂H₁₁NO₃ Acenaphthenesulfonamide, 274⁸.
- C₁₂H₁₁NO₃ 3 - Indolebutyric acid, γ - keto -, 279⁷.
- 3 - Indoleglyoxylic acid, Et ester, 279⁷.
- , 2-methyl-, Me ester, 280⁴.
- C₁₂H₁₁NO₃ Cinnamic acid, α -cyano-3,4-dimethoxy-, 2653¹.
- C₁₂H₁₁NO₃ 3 - Pyrrolidineacetic acid, 3 - hydroxy - 2,5 - diketo - 1 - phenyl-, 3255⁷.
- C₁₂H₁₁NS Benzenesulfenamide, 1855⁴.
- C₁₂H₁₁NS₂ Dibenzene-sulfenamide, 1855⁴.
- 2 - Isothiazoloquinolinone, 10,10 - dihydro-10-methylthio-, 289¹.
- C₁₂H₁₁N₂O 1,4 - Naphthylenediamine, N¹-acetyl-3-nitro-, 2200⁸.
- C₁₂H₁₁N₂O₂ *o* - Cresol, 4,6 - dinitro-, pyridine salt, 1133¹.
- C₁₂H₁₁N₂O₂ β - Picoline, 2 - amino-, picrate, 518¹.
- C₁₂H₁₁AsN₂ Arsenobenzene, *m,m'* - dianuno-, and di-HCl, 2815¹.
- C₁₂H₁₁AsN₂O₂ *p* - Arsenophenol, 3,3' - diamino-, 79².
- C₁₂H₁₁BN₂O Dipyrrocatecholboric acid, NH₃ salt, 2175¹.
- C₁₂H₁₁ClNO Phthalimide, N - [β - (β - chloroethoxy)ethyl], 1413¹.
- C₁₂H₁₁ClNO₂ Aniline, chloro-, benzenesulfonate, 631².
- C₁₂H₁₁Cl₂CoN₂ Compd. from CoCl₂ and benzdine, 2944⁷.
- C₁₂H₁₁Cl₂CuN₂ Compd. from CuCl₂ and benzdine, 2944⁷.
- C₁₂H₁₁Cl₂HgN₂ Compd. from HgCl₂ and benzdine, 2944⁷.
- C₁₂H₁₁Cl₂Te 1,2 - Telluropyran - 3,5(4,6)-dione, 4 - benzyl-, 1,1 - dichloride, 2027¹.
- C₁₂H₁₁Cl₂FeN₂O₂, 942⁷.
- C₁₂H₁₁CoN₂O₂ Compd. from Co(NO₂)₂ and benzdine, 2944⁷.
- C₁₂H₁₁CuN₂O₂, 1990⁴.
- C₁₂H₁₁CuN₂O₂ + H₂O Compd. from Cu(NO₂)₂ and benzdine, 2944⁷.
- C₁₂H₁₁MgN₂ Magnesium anilide, 641¹.
- C₁₂H₁₁NO₂Sb, 2310¹.
- OnH₂N₂ (See also *Benzidine*.)
Hydrazobenzene, 2416¹; *ferrihydrazide*, 978¹.
- C₁₂H₁₁N₂O¹, 4'(5') - Spiro[cyclopropanepyrrole]-5'-one, 3' - methyl-1' - phenyl¹, and isomer, 2800¹.
- C₁₂H₁₁N₂O₂ Cinchoninic acid, 3-amino-2-methyl-, Me ester, 2955⁴.
- 4(or 5) - Imidazolecarboxylic acid, 5(or 4) - phenyl-, Et ester, 1706⁹.
- C₁₂H₁₁N₂O₂S Aniline, *m,m'* - sulfonylbis-, 4(or 5) - Imidazolecarboxylic acid, 2 - mercapto-5(*or* 4) - phenyl-, Et ester, 1706⁹.
- 5 - Thiazolecarboxylic acid, 2 - amino - 4 - phenyl-, Et ester, 2931¹.
- C₁₂H₁₁N₂O₂S₂ Disulfoxide, bis(*p* - aminophenyl), 476¹.
- C₁₂H₁₁N₂O₂ (See also *Phenobarbital*.)
Barbituric acid, 5-phenethyl, 471¹.
- Hydantoin, 5-anisal-3-methyl-, 630⁷.
- 3-Indoleglyoxylic acid, Et ester, oxime, 279⁷.
- Isoquinalamide, 6,7 - dimethoxy-, 2668⁹.
- C₁₂H₁₁N₂O₂S Hydantoin, 1 - acetyl-5-*p* - anisyl-2-thio-, 637¹.
- C₁₂H₁₁N₂O₂S Acenaphthenedisulfonamide, 275¹.
- C₁₂H₁₁N₂O₂ Glyoxylohydroxamic acid, oxime, di-Ac deriv., 2638¹.
- C₁₂H₁₁N₂O₂S Aniline, *m* nitro-, benzenesulfonate, 651¹.
- C₁₂H₁₁N₂S Aniline, *o*, *p'* and *p,p'*-thiobis-, 401¹.
- C₁₂H₁₁N₂S See *Intramine*.
- C₁₂H₁₁N₂Se₂ Aniline, *o,o'* - diselenobis-, 1863¹.
- C₁₂H₁₁N₂Se₂Zn Aniline, *o,o'*-diselenobis-, Zn salt, 1863¹.
- C₁₂H₁₁N₂ Aniline, *m,m'*-azobis-, 256⁹.
- C₁₂H₁₁N₂O₂ Isoxazole, 3,5 - dimethyl - 4 - (3-nitro *p* tolylazo)-, 3090⁴.
- C₁₂H₁₁N₂O₂ Urocanic acid, 1731¹.
- C₁₂H₁₁N₂O₂S₂ Benzenesulfonic acid, 4,4'(and 5,5')-azobis[2-amino-, 1857¹.
- C₁₂H₁₁O Ether, methyl 6-methyl-2-naphthyl-, 2819⁷.
- 2-Naphthol, 1-ethyl-, 59¹.
- C₁₂H₁₁O₂ Borneol, acetate, 2657¹.
- Cinnamic acid, allyl ester, 1401⁴.
- Compd., m. 190.1°, from cyclopentadiene and quinone, 2499⁴.
- 1 - Naphthaleneacetic acid, 3,4 - dihydro-, 2201¹.
- Δ^1 - Naphthaleneacetic acid, 3,4 - dihydro-, 2201¹.
- 2 - Naphthoic acid, 3,4 - dihydro - 1 - methyl-, 1268¹.
- C₁₂H₁₁O₂Te 1,2 - Telluropyran - 3,5(4,6)-dione, 4-benzyl-, 2027¹.
- C₁₂H₁₁O₂ 2 Butanone, 1 piperonylidene-, 467¹.
- C₁₂H₁₁O₂ (See also *Tubane* acid.)
Acetylphenone, β - carboxyoxyl, Et ester, 2049¹.
- 5 - Benzofuranol, β - methyl-, Et bicarbonate, 2665⁴.
- Δ^1 - 2 - Butenol, acid phthalate, 2331¹.
- Chromone, 3,7 - dimethoxy - 2 - methyl-, 517¹.
- Cyclodecanebiscyclobutanedione, 1400¹.
- 1,2 - Naphthalenedicarboxylic acid, 1,2,3,4-tetrahydro-, 1269¹.
- C₁₂H₁₁O₂ 3,5 - Benzofurandiol, 1,2 - dihydro-, diacetate, 484¹.
- Coumarin, 3,5,7 - trimethoxy-, 664¹.
- Malonic acid, (α -benzoylthyl)-, 663¹.
- C₁₂H₁₁AgClNO₂ Carbamic acid, ethylhydroxy-, Et ester, *p*-chlorobenzoate, Ag salt, 970¹.
- C₁₂H₁₁AgN₂O₂ Carbamic acid, hydroxy-, Bu ester, *m*(and *p*) - nitrobenzoate, Ag salt, 970¹.

- $C_{11}H_{13}BO_4 + 2H_2O$, 1386².
 $C_{11}H_{13}BrO_2$ Cinnamic acid, α (and β)-bromo-*p*-methoxy-, Et ester, 3264².
 $C_{11}H_{13}Br_2IN$ 1-Ethylquinolinium iodide, $CHBr_2$ addn. compd., 1403¹.
 $C_{12}H_{13}Br_2O_2$ Hydrocinnamic acid, α, β -tribromo-*p*-methoxy-, Et ester, 3264².
 $C_{10}H_{11}ClO$ 1(and 2) - Acetonaphthone, α -chloro-5,6,7,8-tetrahydro-, 1272¹.
 $C_{12}H_{13}IN$ 1-Ethylquinolinium iodide, $CHBr_2$ addn. compd., 1403¹.
 $C_{12}H_{13}NO_2$ 2-Indolecarboxylic acid, 5 methyl-, Et ester, 830^{1,2}.
Oxerolepe, 2957².
Pseudogeneserolene, 1700².
 $C_{12}H_{11}NO_3S$ Aniline, benzenesulfonate, 651².
 $C_{12}H_{11}NO_3S$ Hydrocinnamic acid, α -cyano 3,4 dimethoxy-, 2653².
 $C_{12}H_{11}NO_3$ Glutamic acid, *N*-salicylal, Bu salt, 2640¹.
Succinic acid, α -phenacyl-, oxime, 246².
 $C_{12}H_{11}NO_3$ Phthalic acid, 3-nitro-, 2 Methyl ester, 2940¹.
Terephthalic acid, 2 nitro-, di-Et ester, 1700².
 $C_{12}H_{11}N_2NaO_2$ 2,4-Pentanedione, 3-*p*-tolylazo-, Na salt, 3000².
 $C_{12}H_{11}N_2O_2PS$ Thiophosphate hydrazide, di-Ph ester, 2326¹.
 $C_{12}H_{11}N_2O$ Isoxazole, 3,5-dimethyl-4-*p*-tolylazo-, Na salt, 3090².
1,2,4-Naphthalenetriamine, *N*³-acetyl-, 2201².
 α, γ -Pentadienylaldehyde, δ -phenyl-, semi-carbazone, 2941¹.
Pyrazole, 3,5-dimethyl-1-phenylcarbamyl-, 3082².
 $C_{12}H_{11}N_2OS$ 1,3,4-Thiadiazole, 3-acetyl-2,3-dihydro-5-methylmercapto-2-*p*-tolylimino-, 988².
 $C_{12}H_{11}NO_3$ 3,5-Butenone, 4-hydroxy-, benzoate, semicarbazone, 2953².
4-Imidazolecarboxamide, tetrahydro-2,5-diketo-*N*,3-dimethyl-1-phenyl-, 2810².
1-Indanacetic acid, 3-keto-, semicarbazone, 491².
 $C_{12}H_{11}NO_3$ 4-Imidazolecarboxamide, tetrahydro-4-hydroxy-2,5-diketo-*N*,3-dimethyl-1-phenyl-, 2811².
2,4-Pentanedione, 3-(3-nitro-*p*-tolylazo-), 3090².
 $C_{12}H_{11}N_2S$ 2,3-Thiazolone, 4-phenyl-, isopropylidenehydrazide, 831¹.
 $C_{12}H_{11}NO_3S$ Benzenesulfonic acid, *p*-triag-, phenylhydrazine salt, 1253².
 $C_{12}H_{11}Acenaphthene$, tetrahydro-, 829², 2470².
 $C_{12}H_{11}BaCdCl_2N_2$, 2174².
 $C_{12}H_{11}BeCl_2N_2$, 3071².
 $C_{12}H_{11}BrNO_2$ Cunic acid, 2-acetamido 5-bromo-, 641².
 $C_{12}H_{11}Br_2O_2$ 3-Pentanone, 1,2-dibromo-1-*p*-anisyl-, 467¹.
 $C_{12}H_{11}Br_2O_2$ Hydrocinnamic acid, α, β -dibromo-*p*-methoxy-, Et ester, 3264².
 $C_{12}H_{11}ClNO_2$ Isobutyranilide, β -chloro- α -hydroxy-, acetate, 264².
 $C_{12}H_{11}ClNO_2$ Carbamic acid, ethylhydroxy-, Et ester, *p*-chlorobenzoate, 970¹.
 $C_{12}H_{11}Cl_2Cr_2MO$, 1385².
 $C_{12}H_{11}INO$ 3-Methoxy-1,2-dimethylquinolinium iodide, 1272².
8-Methoxy-1-methylquinazolinium iodide, 2668².
 $C_{12}H_{11}INO_2$ Isoquinoline, 6,7-dimethoxy-, methiodide, 2955².
 $C_{12}H_{11}NO_3Sb + H_2O$ Acetophenone, *p*-amino-, antimonyl tartrate, 1256².
 $C_{12}H_{11}N_2O$ Isoindazole, 1-isovaleryl-, 5098².
 $C_{12}H_{11}N_2O_2$ Hydantoin, 5-isopropyl-5-phenyl-, 1253¹.
-, 5-phenyl-5-propyl-, 1253¹.
Ketone, 2-keto-1-methyl-3-piperidyl 3-methyl-, 657².
2,4-Pentanedione, 3-*p*-tolylazo-, 3090².
2,5-Piperazinedione, 3-benzyl-6-methyl-, 2810².
Quinone, 2,5-bis(allylamino)-, 259².
Tryptophan, 5-methyl-, 830¹.
 $C_{12}H_{11}NO_3Te$ 1,2-Telluropyran-3,5(4,6)-dione, 4-benzyl-, dioxime, 2027².
 $C_{12}H_{11}N_2O_2$ Hydantoin, 5-*p*-methoxybenzyl-3-methyl-, 636².
 $C_{12}H_{11}N_2O_2$ Glycine, benzoylalanyl-, 3085².
Malonic acid, acetonyl-, phenylhydrazide, 3480².
 $C_{12}H_{11}N_2O_3$ Citric acid, amide anilide, 3256¹.
Succinamic acid, α -hydroxy- α -(phenylcarbamyl)methyl-, 3256².
 $C_{12}H_{11}N_2O_3S$ Cyclohexenesulfonic acid, dihydroxyketo-, phenylhydrazide, Na salt, 481².
 $C_{12}H_{11}N_2O_3$ Carbamic acid, ethylhydroxy-, Et ester, *m*(and *p*)-nitrobenzoate, 970¹.
-, hydroxy-, Bu ester, *m*(and *p*)-nitrobenzoate, 970¹.
 $C_{12}H_{11}N_2$ Pyrazole, 3,5-dimethyl-4-*p*-tolylazo-, and salt, 3090².
 $C_{12}H_{11}N_2O_2P_2S$ Tetraazaphosphonium, *P, P'*-diphenoxy-*P, P'*-dithio-, 2326¹.
 $C_{12}H_{11}NO_2$ 2,4-Pentanedione, 3-(3-nitro-*p*-tolylazo-), oxime, 3090².
 $C_{12}H_{11}O$ Pentenophenone, methyl-, 1134¹, 2474².
 $C_{12}H_{11}O_2$ γ -Butenophenone, α -methoxy-, 466².
2,4-Hexanedione, 3-phenyl-, 1558².
1-Naphthaleneacetic acid, 1,2,3,4-tetrahydro-, 2202².
2-Naphthoic acid, 1,2,3,4-tetrahydro-1-methyl-, 1266².
2,4-Pentanedione, 3-benzyl-, 2627².
3-Pentenone, 1-*p*-anisyl-, 467¹.
 $C_{12}H_{11}O_2$ Cinnamic acid, *p*-methoxy-, Et ester, 3263².
1-Naphthaleneacetic acid, 1,2,3,4-tetrahydro-1-hydroxy-, and salt, 2201².
3-Pentenone, 1-(4-hydroxy-*m*-anisyl)-, 2943².
Valeraldehyde, γ -hydroxy-, benzoate, 2931².
 $C_{12}H_{11}O_2$ Lactic acid, benzoate, 1407²; Et ester, benzoate, 243².
Phthalic acid, di-Et ester, 151², 152², 452², 1113², 1753², 2537², 2923², 3001²; mono-Bu ester, *P* 3491².
Terephthalic acid, di-Et ester, $SnCl_4$ and $SnCl_2$ addn. compds., 51².
 $C_{12}H_{11}O_2$ Isophthalic acid, 2,6-trihydroxy-, di-Et ester, 668².
 $C_{12}H_{11}BrN_2OS$ Urea, β -allyl- α -(*p*-bromophenyl)- α -(β -hydroxyethyl)thio-, 2481².
 $C_{12}H_{11}BrN_2O_2$ Malonamide, α -bromo-*N*-ethyl-*N'*-*p*-tolyl-, 1697¹.
 $C_{12}H_{11}BrO_2$ Caproic acid, α -bromo- α -phenoxy-, 471².
 $C_{12}H_{11}Br_2Cl$ Camphor, β -(β, γ -dibromo- γ -chloropropyl)-, 2645².
 $C_{12}H_{11}BrNO_2$ 2-Pyrrolepropionic acid, α, β

- † dibromo - 4 - carboxy - 3,5 - dimethyl-, mono-Et ester, 2833².
- C₁₂H₁₁Br₂N₂O₂S Urea, α - (β,γ - dibromopropyl)-, β - (3 - nitro - *p* - phenethyl)thio-, 57².
- C₁₂H₁₁Cl Cumene, *p*-γ-chloroallyl-, 2645¹.
- C₁₂H₁₁N₂ Allylethylindazolium iodide, 3091^{1,2}.
- C₁₂H₁₁N₂O Vasicine, methiodide, 2801⁴.
- C₁₂H₁₁N₂O Antipyrine, methiodide, diiodide, 1403².
- C₁₂H₁₁N Indole, 1-butyl-, 1862².
- , 2-isobutyl-, 1277².
- α-Tolunitrile, α-isopropyl-4-methyl-, 51².
- C₁₂H₁₁NO α - Pentenophenone, *p* - amino - γ-methyl-, *and* -HCl, 2474⁴.
- 2 - Propanone, 1 - (1,2,3,4 - tetrahydro-1-quinolyl)-, 511⁴.
- C₁₂H₁₁NO₂ Hydroxeresolene, 2600⁴.
- Isoquinoline, ethoxy - 3,4 - dihydro - methoxy-, 2950⁴.
- 8 - Methoxy - 1 - methylquinadinium hydroxide, *and* salts, 2668².
- 2 - Naphthol, 7 - acetamido - 5,6,7,8 - tetrahydro-, 497².
- C₁₂H₁₁NO₂ (See also *Hydrocotarnine*.)
- Acetamide, *N* - [γ - (3,4 - methylenedioxyphenyl)propyl]-, 2652².
- Alanine, *N* - benzoyl-, Et ester, 244².
- Aganobutyl, ethoxy - 3,4 - dihydro - methoxy-, 2950⁴.
- Valeric acid, δ-anthranoyl-, 3263².
- C₁₂H₁₁NO₂ (See also *Cotarnine*.)
- Carbamic acid, ethylhydroxy-, Et ester, benzoate, 969².
- , hydroxy-, Bu ester, benzoate, 969².
- , (φ - methoxyphenacyl)-, Et ester, 519².
- Carbanilic acid, *p* - carboxy-, di-Et ester, 979².
- Nicotinic acid, 5 - acetyl - 1,6 - dihydro-6 - keto - 1,2 - dimethyl-, Et ester, 2497².
- , 5 - acetyl - 4 - ethyl - 1,6 - dihydro - 6 - keto - 1,2 - dimethyl-, 2497².
- 2-Pyrroleacrylic acid, 4-carboxy - 3,5 - dimethyl-, mono-Et ester, *and* *Ag* salt, 2663².
- Terephthalic acid, ethylamino-, di-Me ester, 490⁴.
- C₁₂H₁₁NO₂ Valeric acid, δ-amino-α,γ-dihydroxy-, *Bz* deriv., 635².
- C₁₂H₁₁NO₂ 5,5 - *m* - Dioxanedicarbinol, 2 - (o-nitrophenyl)-, 2932².
- Serine, β - (φ - carbethoxyoxyphenyl)-, -HCl, 76^{2,6}.
- C₁₂H₁₁NO₂ Malonic acid, aniline salt, 2034².
- Glucoside, nitrophenyl-, 643¹.
- C₁₂H₁₁N₂O₂Sb + H₂O Acetanilide, *p* - amino-, antimony salt, 1266².
- C₁₂H₁₁N₂O₂ Cyclopropanecarboxamide, 1-acetyl-, phenylhydrazone, 2809¹.
- 1 - Indanone, 2-ethyl-, semicarbazone, 494⁴.
- C₁₂H₁₁N₂O₂ Δ² - Cyclohexenone, 5 - furyl - 2-methyl-, semicarbazone, 3484⁴.
- C₁₂H₁₁N₂O₂ Acetanilide, α - [(*N* - acetylglucyl)aminol-, 470².
- 1,3 - Butanedione, 1 - (2,3 - cresyl)-, semicarbazone, 1423².
- Butyric acid, β - benzoyl-, semicarbazone, 503².
- Hydrocinnamic acid, α - acetyl-, semicarbazone, 1409⁴.
- C₁₂H₁₁N₂O₂S Urea, α - allyl⁶ - β - (3 - nitro - *p* - phenethyl)thio-, 57².
- C₁₂H₁₁N₂O₂ γ - Butenophenone, 3,4,5 - trihydroxy-, semicarbazone, 467¹.
- Olefinide, *N* - phenyl-, 3266².
- Urea, α - allyl - β - (nitro - *p* - phenethyl)-, 57².
- C₁₂H₁₁N₂O₂ Chelidonic acid, di-Et ester, semicarbazone, 510².
- C₁₂H₁₁ Compd., *m*. 54-5°, from reaction of tetralin and AlCl₃, 1271².
- C₁₂H₁₁AsNO₂ Carbanilic acid, 5 - arsono - 2-(carboxyoxo)-di-Et ester, 979².
- C₁₂H₁₁Br₂N₂ Phenazine, dibromodecahydro-, 2499^{2,6}.
- C₁₂H₁₁Br₂N₂O₂ Urea, α - (β,γ - dibromopropyl)-β-*p*-phenethylthio-, 57².
- C₁₂H₁₁Br₂N₂O₂ Urea, α - (β,γ - dibromopropyl)-β-*p*-phenethyl-, 57².
- C₁₂H₁₁Br₂N₂O₂ Rhamnose, (dibromophenyl)hydrazone, 44².
- C₁₂H₁₁Br₂N₂O₂ Galactose, (dibromophenyl)hydrazone, 44².
- d*-Glucose, (3,5 - dibromophenyl)hydrazone, 44².
- C₁₂H₁₁N₂ Phenazine, octahydro-, *and* -HCl, 2499².
- C₁₂H₁₁N₂O₂ Δ² - Thiazoline, 2 - azulino - 5-ethoxy-4-methyl-, W10¹.
- , 5 - methyl-α2 - *p* - phenetidino-, 57².
- Urea, α - allyl - β - *p* - phenethylthio-, 57².
- C₁₂H₁₁N₂O₂ Cyclohexanecetic acid, α,1⁶ - dicyano-, Et ester, 268².
- Malonamide, *N* - ethyl - *N'* - *p* - tolyl-, 1697¹.
- 1 - Naphthaleneacetic acid, 1,2,3,4 - tetrahydro - 1 - hydroxy-, hydrazide, 2201².
- Urea, α - allyl - β - *p* - phenethyl-, 57².
- Vasicine, methoxyhydroxide, 2501⁴.
- C₁₂H₁₁N₂O₂S Δ² - Pyrazoline, 5-ethyl-4-methyl-1 - (phenylsulfonyl)-, 2666².
- C₁₂H₁₁N₂O₂ Barbituric acid, cyclohexenyl-5-ethyl-, P 3560^{2,4}.
- Glycine, *N* - (*N* - phenylglycyl)-, Et ester, 3083².
- C₁₂H₁₁N₂O₂ Terephthalic acid, 2,5-diamino-, di-Et ester, *and* *di*-HCl, 1274¹.
- C₁₂H₁₁N₂O₂S Taurocarbanilic anhydride, *N*-*p*-phenethyl-β-methyl-, 57².
- C₁₂H₁₁N₂O₂ Valeric acid, δ-amino-α,γ-dihydroxy-, phenylurea deriv., 635².
- C₁₂H₁₁N₂O₂ Malonamide, *N*, *N'* - dimethyl-α-phenylcarbamido-, 2811².
- C₁₂H₁₁N₂O₂ 2 - Propanone, 1 - (ethylmethylamino)-, picrate, 511².
- C₁₂H₁₁O Benzofuran, 1 - ethyl - 1,2 - dihydro-2,4-dimethyl-(?), 2038².
- Chroman, 2,4,6 - trimethyl-(?), 2038².
- p* - Cresol, 2 - (α - methyl Δ² - butenyl)-, 2039².
- Curcumone, 277^{2,2}.
- 2-Hexanone, 6-phenyl-, 1899².
- Isocaprophenone, 1899².
- C₁₂H₁₁O₂ Acetophenone, 2-isopropoxy-5-methyl-, 1405².
- 2 - Butanol, 4 - phenyl-, acetate, 2331².
- Butyric acid, γ-phenyl-, Et ester, 1260⁴.
- Butyrophenone, *p*-methoxy-, 266².
- Enanthaldehyde, α-2-fural-, 1129².
- Hydratropic acid, 4-methyl-, Et ester, 277⁴.
- 3-Pentanol, 1-phenyl-, formate, 2331².
- α - Toluic acid, α - ethyl - φ - methyl-, Me ester, 277².
- , α - isopropyl - 4 - methyl-, *and* salts, 51².
- C₁₂H₁₁O₂ (See also *Eleostein*.)
- 3 - Pentanone, 1 - (4 - hydroxy - *p* - anisyl)-, 2043².

- p* - Toluic acid, α - hydroxy-, Bu and isobutyl esters, 1417⁴.
- $C_{12}H_{11}O_4$ Acetophenone, α , 3,4,5-tetramethoxy-, 1141⁴.
- $C_{12}H_{11}O_5S$ Lactic acid, Et ester, *p*-toluenesulfonate, 244⁴, 1407^{2,3}.
- $C_{12}H_{11}O_7$ Arbutin, 41².
- $C_{12}H_{11}AsN_2O_7$ *o* - Benzenedicarbamic acid, 4-arsono-, di-Et ester, 979⁴.
- $C_{12}H_{11}Br$ *m* - Xylene, 2-bromo-4,6-diethyl-, 1275⁴.
- $C_{12}H_{17}BrO_2 \Delta^{1,2}$ 8-*p*-Menthadienol, 9-bromoacetate, 2942⁹.
- $C_{12}H_{17}BrO_4$ Aconitic acid, α -bromo-, tri-Et ester, 470⁴.
- $C_{12}H_{17}ClN_2O_3$ 3 - Pyrroledicarboxylic acid, (α -chloroacetamidomethyl)dimethyl-, Et ester, 2336⁷.
- $C_{12}H_{17}ClO_4$ γ - Pentenic acid, α - acetyl - α - (β -chloropropionyl)-, Et ester, 466⁷.
- $C_{12}H_{17}IN_2$ 2 - Butyl - 1-methylindazolium iodide, 3091⁴.
- Ethylpropylindazolium iodide, 3091⁴.
- $C_{12}H_{17}NO$ Acetophenone, 2,5-diethyl-, oxime, 1405⁹.
- Curcume, oxime, 277^{4,9}.
- Propiophenone, *p*-dimethylamino-, 267⁴.
- α -Tlbumide, α -isopropyl 4-methyl-, 51⁴.
- $C_{12}H_{17}NO_2$ Acetophenone, 2 - isopropoxy - 5-methyl-, oxime, 1405⁴.
- Enanthaldehyde, α -2-fural, oxime, 1139².
- $C_{12}H_{17}NO_4$ 3,4 - Pyrroledicarboxylic acid, 2,5-dimethyl-, di-Et ester, 1420⁴.
- 3 - Pyrrolopropionic acid, 4 - carboxy-2,5-dimethyl-, 2823⁷.
- , 5 - carboxy 2,4 - dimethyl-, mono-Et ester, 2336⁴.
- $C_{12}H_{17}NO_5S$ Alanine, *N* - *p* - tolylsulfonyl-, Et ester, 244⁴.
- $C_{12}H_{17}NO_5$ Benzylamine, α -methyl-, malate, 1415⁷.
- $C_{12}H_{17}N_2S$ Carbanilic acid, isoamylidithio-, salts, 973⁴.
- $C_{12}H_{17}N_2O_2$ Acetophenone, 2-ethoxy-5-methyl-, semicarbazone, 1405⁴.
- 2 - Butanone, 3 - *p* - anisyl-, semicarbazone, 823⁴.
- Homoanisaldehyde, α , α - dimethyl-, semicarbazone, 823⁴.
- Indazole, 3 - acetamido - 2 - acetyl - 4,5,6,7-tetrahydro-7-methyl-, 1263¹.
- Isobutyrophenone, *p* - methoxy-, semicarbazone, 823⁴.
- $C_{12}H_{17}N_2O_7$ Sugar from Hamameli tannin, *p*-nitrophenylhydrazones, 260⁷.
- $C_{12}H_{17}O_7$ Resorcinol, hexyl-, 1161⁴.
- $C_{12}H_{17}$ Benzene, dipropyl-, 1405⁹.
- Hexane, 1-phenyl, 977⁴, 1899⁴.
- $C_{12}H_{17}Al$ Allylethylmethylphenylarsonium iodide, 1403⁴.
- $C_{12}H_{17}AsNO_4$ Carbanilic acid, 5-arsono-2-methyl-, Bu and isobutyl esters, 979⁴.
- $C_{12}H_{17}BrNO_5S$ α - Camphorsulfonamide, β -bromo-, Ac deriv. of enol form, 1137⁴.
- $C_{12}H_{17}IN$ 1,2 - Dimethyl - 1 - phenylpyrrolidinium iodide, 1862¹.
- $C_{12}H_{17}INO$ 1,2,3,4 - Tetrahydro - 2 - β - hydroxyethyl - 2 - methylisoquinolinium iodide, 825¹.
- $C_{12}H_{17}N_2S$ Hydrazine, α - cyclohexyl β - phenyl-, 643⁴.
- $C_{12}H_{17}N_2O_2$ (See also *Tulocaine*.)
- Carbamic acid, (dimethylaminoethyl)-, benzyl ester and *HCl*, P 1787⁷.
- $C_{12}H_{11}N_2O_2S$ Urea, α - 4,5 - dimethoxy γ - propylphenylthio-, 2474⁴.
- $C_{12}H_{11}N_2O_4$ Barbituric acid, 5-allyl-5-isoamyl-, 2641².
- 3 - Pyrroledicarboxylic acid, 4 - (α -acetamidomethyl) - 2,5 - dimethyl-, Et ester, 2336⁷.
- Urea, α - (4,5 - dimethoxy - 2 - propylphenyl)-, 2474⁴.
- $C_{12}H_{11}N_2O_4$ 3,4 - Pyrroledicarboxylic acid, 1- amino - 2,5 - dimethyl-, di-Et ester, 1420⁴.
- $C_{12}H_{11}N_2O_5$ *d*-Glucose, phenylhydrazone, 2034⁴.
- $C_{12}H_{11}N_2O_6$ Hexonic acid, phenylhydrazide, 260⁹.
- $C_{12}H_{11}N_2Pb_3$ Lead tricyanomelamine, 3228¹.
- $C_{12}H_{11}NO$ Anisole, *p*-amyl-, 266⁹.
- Bornylene, 3-acetyl-, and -*HBr*, 1263⁷.
- Curcume, 74².
- Cyclohexanone, cyclohexylidene-, 2941⁸.
- Ether, benzyl isoamyl, 2194⁴.
- 3-Hexanol, 1-phenyl-, 2331¹.
- $C_{12}H_{15}O_2$ Furofuran, 1,1,3,3,4,4 - hexamethyl-, 502².
- Propionic acid, (γ - cyclohexylpropyl)-, 3476⁴.
- Resorcinol, hexyl-, 3113⁹.
- α , α' - *p* - Xylenediol, α , α' , α' - tetramethyl-, 358⁹.
- $C_{12}H_{15}O_5S$ *p* Toluenesulfonic acid, Am ester, 977⁴.
- $C_{12}H_{15}O_4$ Cyclohexanemalononic acid, 2 - hydroxy-4-methyl-, lactone, ethyl ester, 2644⁷.
- $C_{12}H_{15}O_4$ 3,7 - Spirononane - 1,2 - dicarboxylic acid, 1-methoxy-, 2934⁴.
- $C_{12}H_{15}O_6$ Acid from the γ -lactone diethyl ester of 2 hydroxy - 3,3-dimethyl - 1,2,4-pentanetricarboxylic acid, m. 123⁹ (decompn.), 2329⁴.
- Pseudoglucal, diacetate, Et cycloacetal, 2478⁹.
- $C_{12}H_{15}O_7$ Oxalosuccinic acid, tri-Et ester, 2478².
- $C_{12}H_{15}BrClNO_5S$ π - Camphorsulfonamide, 2-bromo-*N*-chloro-*N*-ethyl-, 2943¹.
- $C_{12}H_{15}BrO_2$ α - Campholenic acid, α - bromo-, Et ester, 487⁴.
- $C_{12}H_{15}N$ Aniline, *N*, *N*-dipropyl-, 2814⁴.
- $C_{12}H_{15}NO$ Bornylene, 3-acetyl-, oxime, 1263⁴.
- Curcume, oxime, 74⁴.
- 3 - Pentanol, 3 - (α - amionbenzyl)-, and -*HCl*, 635⁴.
- $C_{12}H_{15}NO_2$ Cyclopentanecarboxylic acid, 3-cyanomethyl - 1,2,2 - trimethyl-, Me ester, 1703⁴.
- $C_{12}H_{15}NO_5S$ Benzenesulfonamide, 2(or 5)-amyl-5(or 2) methoxy-, 267⁴.
- $C_{12}H_{15}NO_6$ Malonic acid, allyl (piperidylmethyl)-, 3084⁴.
- $C_{12}H_{15}N_2O \Delta^4$ 2 - Bicyclo[2.2.2]octenone, 1,3,3-trimethyl-, semicarbazone, 3087⁷.
- $C_{12}H_{15}N_2O_4$ 1,1 - Cycloheptanediacetic acid, α -aceto-, semicarbazone, *Na* salts, 2934⁴.
- $C_{12}H_{15}NaO_5$ Mannose, diacetone-, mono-*Na* salt, 1561⁴.
- $C_{12}H_{15}$ Acenaphthene, decahydro-, 829⁴.
- Diprene, dimethyl-, 648².
- Hexine, cyclohexyl-, 966⁹.
- $C_{12}H_{15}Cl_2N_2NO_4$ + H_2O Compd. from $NiCl_2$ and benzidine, 2944⁷.
- $C_{12}H_{15}Cl_2O$ Ether, bis(2 - chlorocyclohexyl)-, 2031¹.
- $C_{12}H_{15}Cl_2O_7$ 1,2 - Telluropyra - 3,5(4,6)-dione, 2 - heptyl-, 1,1 - dichloride, 2027⁴.
- $C_{12}H_{15}Cl_2CrNO_3$, 1385⁹.
- $C_{12}H_{15}Cl_2MnN_2$, 1385⁴.

- C₁₂H₂₀IN** Tetraallylammonium iodide, 1403¹.
C₁₂H₂₀IP Phosphine, *c* triethyl-, PhI addn. compd., 2323⁶.
C₁₂H₂₀N₄ Cyclohexanone, azine, 2343⁴.
 Ethylenediamine, *N,N* - diethyl - *N'* - phenyl-, 283¹.
 Succinonitrile, tetraethyl-, 1853⁸.
C₁₂H₂₀N₂O₂ 4-Pyridylsuccinic acid, 2,3,4,5-tetrahydro - 4 - isobutyl - 3 - keto-6-methyl-, Et ester, 3480⁷.
C₁₂H₂₀N₄ Butyronitrile, α,α' -diazobis[α -ethyl-, 1853⁸.
C₁₂H₂₀O Camphane, 3-acetyl-, 1264¹.
C₁₂H₂₀O₂ Δ^1,α - Cyclohexanecarboxylic acid, α ,3-dimethyl-, Et ester, 2030⁶.
 —, 5 - isopropyl - 2 - methyl-, 2030⁷.
 Cyclopentane, 1,3 - diacetyl - 1,2,2 - trimethyl-, 2656⁹.
 Fenchyl alcohol, acetate, 2657^{2,3}.
 Isoborneol, acetate, 2657².
C₁₂H₂₀O₂Te 1,2 - Telluropyran - 3,5(4,6) di-one, 2-heptyl-, 2027⁸.
C₁₂H₂₀O₄ Dipyrandioxin, 3,4,4i,5i,8,9,9i,10i-octahydro - 5i,10i - dimethyl-, 1400⁸.
 Lactic acid, Et ester, cyclohexanecarboxylate, 244¹.
C₁₂H₂₀O₂ Caronic acid, methoxy-, di-Et ester, 2329⁸.
 Glytaric acid, α - keto - β,β,γ - trimethyl-, di-Et ester, 2329⁸.
 Malonic acid, acetonylethyl-, di-Et ester, 3480⁷.
C₁₂H₂₀O₄ Fructose, diacetone-, 249¹.
 Galactose, diacetone-, 3481⁵.
d-Glucose, diacetone-, 1131⁴.
 Mannose, diacetone-, 1561¹.
 Pseudoglucal, dihydro-, diacetate, Et cycloacetal, 2478^{2,3}.
 Tricarballic acid, tri-Et ester, *SnCl₄* addn. compds., 251².
C₁₂H₂₀O₄ Glycerol, tribicarbonate, tri-Et ester, 468¹.
C₁₂H₂₀O₁₀ Glucosidoglucoside, 975⁷.
C₁₂H₂₀As₂O₄ Benzenearsonic acid, 3-acetamidohydroxy-, diethylamine salt, P 1327².
C₁₂H₂₁Cl₃Te 2 - Hydroxy - 4 - keto - Δ^2 - dodecenyttellurium trichloride, 2027⁸.
C₁₂H₂₁CoN₄O₆, 940⁴.
C₁₂H₂₁KO₁₁, 2272⁸.
C₁₂H₂₁LiO₁₁, 2272⁸.
C₁₂H₂₁N₂O Acetamide, *N* - (decahydronaphthyl)-, 1270^{1,2}.
 Camphane, 3-acetyl-, oxime, 1264¹.
 α - Campholytonitrile, 3,4 - dihydro - 3 - (α -hydroxyisopropyl)-, 2656⁹.
C₁₂H₂₁NOS Carbamic acid, methylthiono-, bornyl ester, 57².
C₁₂H₂₁N₂O₂ Cyclopentanecarboxamide, 3-benzoyl-2,2,3-trimethyl-, 1703¹.
 Oxazole, 5 - ethoxy - 4 - isobutyl - 2 - propyl-, 2051⁸.
 Succinimide, tetraethyl-, 1853⁸.
C₁₂H₂₁NO₂ Alanine, *N* - hexahydrobenzoyl-, Et ester, 244¹.
C₁₂H₂₁NO₄ Galactosamine, diacetone-, and *HCl*, 1560⁸.
 Mannose, diacetone-, primary amine, 1561¹.
C₁₂H₂₁N₂O₂ Barbituric acid, 5 - (β - diethylaminoethyl) - 5 - ethyl-, *HCl*, 1560⁸.
 Cyclohexanecarboxylic acid, 3 - keto - 2,2,4-trimethyl-, Me ester, semicarbazone, 2656⁹.
C₁₂H₂₁N₂O₁₁, 1945¹, 1946¹, 2272⁸.
- C₁₂H₂₁O₂P** Diacetoneglucosephosphoric acid, *Oba salt*, 281⁹.
C₁₂H₂₁CITl Dicyclohexylthallic chloride, 3439⁸.
C₁₂H₂₁N₂O₂ Valeric acid, γ - hydroxy - α - (1-piperidylmethyl)-, lactone, methiodide, 3084⁴.
C₁₂H₂₁N₂O₂Tl Dicyclohexylthallic nitrate, 3439⁸.
C₁₂H₂₁N₂O₂ Menthol, allophanate, 3266⁸.
C₁₂H₂₁N₂O₂ Hydrazine, *s*-bis(piperidylformyl)-, 2461¹.
C₁₂H₂₁N₂O₄ Glycine, leucyldiglycyl-, 2809⁸.
C₁₂H₂₁N₂O₂ Acetic acid, menthyl ester, 2791⁴.
C₁₂H₂₁O₂ Cyclohexanecarboxylic acid, α -hydroxy-, Bu ester, 982⁸.
 —, 1 - hydroxy - α ,3 - dimethyl-, Et ester, 2030⁶.
 —, 1 - hydroxy - 5 - isopropyl - 2 - methyl-, 2030⁷.
C₁₂H₂₁O₂ Malonic acid, isoamyl-, di-Et ester, 2641³.
 —, (β -methylbutyl)-, di-Et ester, 464².
 Sebaccic acid, di-Me ester, *SnCl₄* addn. compd., 50⁸.
C₁₂H₂₁O₂ Tartaric acid, dibutyl ester, 1926⁷.
C₁₂H₂₁O₁₁ (See also *Lactose*; *Maltose*; *Sucrose*; *Trehalose*.)
 Cellobiose, 2035³.
 Gentibiose, 2035³.
d-Glucose, galactosido-, 2812⁹.
 Glucosidoglucose, 975⁷.
 Isotrehalose, 2812⁹.
 Octooxymethylene, diacetate, 1245⁹.
C₁₂H₂₂Sn₂ Benzene, *p*-bis(trimethylstannyl)-, 2929¹.
C₁₂H₂₂N Indole, 1-butylperhydro-, and salts, 1862^{2,3}.
C₁₂H₂₂NO Cyclohexanol, 3-cyclohexylamino, and *HCl*, 2196⁴.
C₁₂H₂₂NO₂ Glycine, *N*-caprylyl-, Et ester, 2051⁷.
 Leucine, *N*-butyryl-, Et ester, 2051⁷.
C₁₂H₂₂N₂O₂ Bis (dihydropseudoglucalyl) imine, 2478⁹.
C₁₂H₂₂NO₁₀ Bisgalactosamine, 1560⁸.
C₁₂H₂₂IN Diallyldiethylammonium iodide, 1403¹.
C₁₂H₂₂N₂O₂ Hydrazine, *s*-dicaproyl-, 815⁸.
C₁₂H₂₂N₂S₂ Disulfide, bis (ϵ -piperidylmethyl)-, and *HCl*, 237⁸.
C₁₂H₂₂N₂O₂ Enanthamide, *N,N* - diethyl - α -keto-, semicarbazone, 2476⁸.
C₁₂H₂₂N₂NiO₂ Compd. from *Ni*(NO₂)₂ and benzidine, 2944⁸.
C₁₂H₂₂O 2-Dodecanone, 2807⁸.
C₁₂H₂₂O₂ See *Lauric acid*.
C₁₂H₂₂O₂ Caprylic acid, γ - formyl-, Me ester, di-Me acetal, 468¹.
C₁₂H₂₂NO₂ Propionaldehyde, β - (γ - ketobutylmethylamino)-, di-Et acetal, and *HCl*, 656¹.
C₁₂H₂₂IN 2 - Propylcyclohexyltrimethylammonium iodide, 1862⁸.
C₁₂H₂₂O₂ Acetaldehyde, di-Am and diisoamyl acetals, 1556⁷.
 Butyraldehyde, diisobutylacetal, 1094⁴.
 3,4 - Decanediol, 3 - ethyl-, 352⁸.
 Isobutyraldehyde, diisobutyl acetal, 2474⁴.
C₁₂H₂₂O₂ Ether, bis (β - butoxyethyl), 634⁴.
C₁₂H₂₂AlO₂ Aluminium butoxide, 1247⁸.
 Aluminium isobutoxide, 1247⁸.
C₁₂H₂₂N₂NO₂, 2175⁸.
C₁₂H₂₂ClN Tetrapropylammonium chloride, 1079⁹.
C₁₂H₂₂Cl₂CrNO, 1385⁸.
C₁₂H₂₂Cl₂MnNO, 1385⁸.

- $C_{13}H_{11}Ge$ Germanium tetrapropyl, 2473.
 $C_{12}H_{21}LiN$ Tetrapropylammonium triiodide, 1403.
 $C_{12}H_{10}BeCl_2N_2O_4$, 3071.
 $C_{12}H_{12}Co_2N_2O_{12}Se + 3H_2O$, 617.
 $C_{12}H_{10}Cl_2N_2O_{12} + 4H_2O$, 2175.
 $C_{12}H_{10}Cl_2PdSb_4$, 1107.
 $C_{12}H_{10}Cl_2PtSb_4$, 1107.
 $C_{12}H_{10}Cl_2PdPtSb_4$, 1107.
 $C_{12}H_{10}Cl_2PtSb_4$, 1107.
 $C_{12}H_{10}Cl_2PtSb_4$, 1107.
 $C_{12}H_{10}Cu_2N_2$ Copper tricyanomelamine, 3228.
 $C_{12}H_{10}La_2N_{12}O_{18} + 4H_2O$, 2175.
 $C_{12}H_{10}N_2Nd_2O_{18} + 4H_2O$, 2175.
 $C_{12}H_{10}N_2O_{18}P_2 + 4H_2O$, 2175.
 $C_{12}H_{10}N_2O_{18}Y_2 + 4H_2O$, 2175.
 $C_{12}H_{10}Sn_2$ Stannopentane, dodecamethyl-, 3250.
 $C_{12}H_{10}Cl_2Co_2N_2Na + 6H_2O$, 68.
 $C_{13}H_4Cl_2N_4O_2$ Carbamide, 4,4' - dichloro-3,5,3',5'-tetranitro-, 2824.
 $C_{13}H_4Br_2N_4O_2$ Hydrazine, α - (α - bromo - *m* - nitrobenzal) - β - (2,4,6 - tribromophenyl)-, 2939.
 $C_{13}H_4ClN_2O_2S$ 3(?) - Acridansulfonyl chloride, 5-keto-9-nitro-, 293.
 $C_{13}H_4Cl_2N_2O_2$ Hydrazine, β - (α - chloronitrobenzal) - β - (2,4,6 - trichlorophenyl)-, 2939.
 $C_{13}H_4HgN_2O_2$ Benzoic acid, 2,4,6 - trinitro, phenylmercuric ester, 2483.
 $C_{13}H_4N_2O_2$ 9-Fluorenone, 2-triazo-, 644.
 $C_{13}H_4N_2O_2$ Phenol, *p*-nitro-, 3,5-dinitrobenzoate, 260.
 $C_{13}H_4N_2O_2$ Nitron, α - (nitrophenyl) - *N* - picryl-, 2039.
 $C_{13}H_4N_2O_{10}$ Benzaldehyde, 2,6 - dinitro, picrylhydrazone, 3092.
 $C_{13}H_4BrN_2O_7$ Ether, 5 - bromo - *m* - tolyl picryl, 1700.
 $C_{13}H_4Br_2O_2$ 3-Xanthanol, dibromo-, 1568.
 $C_{13}H_4Br_2NO$ Aniline, *p*-bromo-*N*-(3,5-dibromosalicylal)-, 259.
 $C_{13}H_4Br_2NO_2$ Cycloiminotoluquinone, (2,4,6-tribromophenyl)-, 2649.
 $C_{13}H_4Br_2NO_2$ Ether, 2,4,6 - tribromophenyl *p*-nitrophenyl-, 3260.
 $C_{13}H_4Br_2N_2O_2$ Hydrazine, α - (α - bromonitrobenzal) - β - (2,4 - dibromophenyl)-, 2939.
 $C_{13}H_4Br_2N_2O_2$ Benzaldehyde, 2,4,6 - tribromo-3-hydroxy-, *p* - nitrophenylhydrazone, 2040.
 $C_{13}H_4ClN$ Acridine, 1-chloro-, 2941.
 $C_{13}H_4ClNO$ Phenol, 3-chloro-2-nitro-, benzoate, 2937.
 $C_{13}H_4ClN_2O_2$ Benzoyl chloride, 4 - anilino-3,5-dinitro-, 2824.
 $C_{13}H_4Cl_2N_2O_2$ Hydrazine, α - (α - chloronitrobenzal) - β - (2,4 - dichlorophenyl)-, 2939.
 $C_{13}H_4Cl_2N_2O_2$ Benzoic acid, nitro-, 2,4,6 - trichlorophenylhydrazide, 2939.
 $C_{13}H_4Cl_2N_2$ Benzaldehyde, α -chloro-, 2,4,6-trichlorophenylhydrazone, 2647.
 $C_{13}H_4N_2O_2S$ 5(10) - Acridone, 1-nitrothio-, 294.
 $C_{13}H_4N_2O_2$ Benzonitrile, 5 - nitro - 2 - phenoxy-, 819.
 $C_{13}H_4N_2O_2$ Phenol, nitrobenzoate, 260.
 $C_{13}H_4N_2O_2S$ 3(?) - Acridansulfonic acid, 5 - keto-9-nitro-, 293.
 $C_{13}H_4N_2O_7$ Carbonic acid, bis (*m* - nitrophenyl) ester, 3269.
 $C_{13}H_4N_2O_2$ Benzonitrile, 5 - nitro - 2 - phenyl-azo-, 8201.
 $C_{13}H_4N_2O_4$ 1,2,3 - Benzotriazole - 5 - carboxylic acid, 7 - nitro - 1 - phenyl-, 2824.
 $C_{13}H_4N_2O_4$ Isoindazole, 4 - nitro - 1 - *p* - chlorophenyl-, 3092.
 $C_{13}H_4N_2O_7$ Nitron, α - phenyl - *N* - picryl-, 2039.
 $C_{13}H_4N_2O_8$ Benzoyl azide, 4 - anilino - 3,5 - dinitro-, 2824.
 $C_{13}H_4N_2O_8$ Benzaldehyde, 2,6 - dinitro-, 2,4-dinitrophenylhydrazone, 3092.
 $C_{13}H_4O$ Fluorenone, 1258.
 $C_{13}H_4OS$ Xanthone, 9-thio-, 1423.
 $C_{13}H_4O_2$ 9-Fluorenone, 2-hydroxy-, 2657.
 $C_{13}H_4O_2$ 9-Fluorenone, 2,7-dihydroxy-, 2657.
 $C_{13}H_4AsCl_2O$ Arsenic, (*o* - benzoylphenyl)di-chloro-, 479.
 $C_{13}H_4O_2$ Benzoyl chloride, γ - (chlorophenylarsyl)-, 479.
 $C_{13}H_4AsO_2$ Arsinous anhydride, - carboxydi-phenyl-, 479.
 $C_{13}H_4AsO_2$ Benzophenone, *o*-arsinoso-, 479.
 $C_{13}H_4AsO_2$ Arsinic anhydride, *o* - carboxydi-phenyl-, 479.
 $C_{13}H_4BrClN_2O_2$ Hydrazine, α - (α - bromo - *m* - nitrobenzal) - β - (*p* - chlorophenyl)-, 2939.
 $C_{13}H_4BrN_2O_2$ Nitron, *N* - (*p* - bromophenyl)- α -(nitrophenyl)-, 1259.
 $C_{13}H_4BrN_2O_2S$ Phenol, 2 - bromo - 4,6 - dinitro-, *p*-toluenesulfonate, 980.
 $C_{13}H_4Br_2ClN_2$ Benzoyl chloride, 2,4 - dibromophenylhydrazone, 2332.
 $C_{13}H_4Br_2NO$ Aniline, *N* - (3,5 - dibromosalicylal)-, 259.
 $C_{13}H_4Br_2NO_2$ Benzophenone, 4 - amino - 3,5 - dibromo-, 1265.
 $C_{13}H_4Br_2NO_2$ Cycloiminotoluquinone, α -(2,4-dibromophenyl)-, 2649.
 $C_{13}H_4Br_2NO_2S$ Phenol, dibromonitro-, *p* - toluenesulfonate, 980.
 $C_{13}H_4Br_2N_2O_2$ Hydrazine, α - (*p* - bromophenyl)- β - (α - bromonitrobenzal)-, 2939.
 $C_{13}H_4Br_2N_2O_2$ Benzaldehyde, 2,4 - dibromo-5 - hydroxy-, *p* - nitrophenylhydrazone, 2040.
 $C_{13}H_4Br_2N_2O_2$ Benzoic acid, nitro-, 2,4 - dibromophenylhydrazide, 2939.
 $C_{13}H_4Br_2N_2O_2$ Benzaldehyde, *p* - bromo-, 2,4 - dibromophenylhydrazone, 2332, 2647.
 $C_{13}H_4Br_2N_2O_2$ Benzoyl bromide, 2,4 - dibromophenylhydrazone, 2332.
 $C_{13}H_4Br_2N_2O$ Salicylaldehyde, 3,5-dibromo-, *p*-bromophenylhydrazone, 259.
 $C_{13}H_4Br_2OS$ Phenol, 2,4,6 - tribromo-, *p*-toluenesulfonate, 980.
 $C_{13}H_4ClN$ Indazole, 5 - chloro - 2 - phenyl-, 2330.
 $C_{13}H_4ClN_2O_2$ Nitron, *N* - (*p* - chlorophenyl)- α - [*m* (and *p*) - nitrophenyl]-, 1259.
 $C_{13}H_4ClO$ Benzophenone, *o*-chloro-, 1406.
 $C_{13}H_4Cl_2NO_2$ Cycloiminotoluquinone, (dichlorophenyl)-, 2649.
 $C_{13}H_4Cl_2NO_2$ Indophenol, 3',5' - dichloromethyl-, 2038.
 $C_{13}H_4Cl_2N_2O_2$ Hydrazine, α - [α - chloronitrobenzal] - β - (*p* - chlorophenyl)-, 2939.
 $C_{13}H_4Cl_2N_2O_2$ Benzoic acid, *m* - nitro-, 2,4 - dichlorophenylhydrazide, 2939.
 $C_{13}H_4Cl_2N_2$ Benzaldehyde, chloro-, 2,4 - dichlorophenylhydrazone, 2647.
 $C_{13}H_4Cl_2N_2O_2$ Hydrazine, α - (α - aminonitro-

- (benzal) - β - (2,4,6 - trichlorophenyl)-, and -HCl, 2039².
- C₁₂H₁₀HgN₂O₂ Toluene, β - picrylmercuri-, 465², 2483².
- C₁₂H₁₀N₂ Acridine, 733², 989², 2054².
7,8' - Benzoquinoline, 2662².
Phenanthridine, 733².
- C₁₂H₈N₂O Acridone, 989².
- C₁₂H₈N₂O Benzoxazole, 1-salicyl-, 1404².
- C₁₂H₈N₂O 9 - Fluorenone, 2,7 - dihydroxy-, oxime, 2657².
- 3,4 - Phenoxazinone, 6-methyl-, 1283².
- C₁₂H₈N₂O Benzoselenazole, 1-phenyl-, 1863².
- C₁₂H₈N₂O Anthranilic acid, *N* - (o - amino-phenyl)-, cyclic amide, nitroso deriv., 294².
- 1,2,3 - Benzotriazole - 1, o - benzoic acid, 294².
- C₁₂H₈N₂O 2,1,3 - Benzotriazole - 2,5' - salicylic acid, 514².
- 1,2 - β - Naphthofurandione, semicarbazone, 64².
- C₁₂H₈N₂O Benzanilide, dinitro-, 260².
- C₁₂H₈N₂O Salicylic acid, 5 - (o - nitrophenylazo)-, and Ca salt, 514².
- C₁₂H₈N₂O 1,4 - Imidazopyridin - 3(2) - one, picrate, 654².
- 7 - Iso - 1,7 - pyrrolopyridin - 3 - ol(2), picrate, 281².
- 1,9 - Pyrrolopyridin - 3 - ol(2), picrate, 281².
- C₁₂H₈ Fluorene, 821², 2300².
- C₁₂H₇AsClO₂ Benzoic acid, o - (chlorophenyl-arsyl)-, 479².
- C₁₂H₇AsN₂O₂ 1,2,3 - Benzotriazine - 3 - *p* - benzencarboxylic acid, 3,4 - dihydro - 4 - keto-, 979².
- C₁₂H₇BrClN₂O Formamidine, *N* (and *N'*) - *p* - bromophenyl - *N'* (and *N*) - *p* - chlorophenyl - N₂ - hydroxy-, and -HCl, 978².
- C₁₂H₇BrN₂O Nitron, *N* - (*p* - bromophenyl)- α -phenyl-, 1259².
- C₁₂H₇BrNO₂ Cycloaminotoluquinone, *p* - bromophenyl-, 2649².
- Nitron, *N* - (*p* - bromophenyl) - α - salicyl-, 1259².
- C₁₂H₇BrN₂O₂ Benzaldehyde, bromohydroxy-, *p* - nitrophenylhydrazone, 2040².
- C₁₂H₇Br₂N₂O Benzaldehyde, (dibromophenyl)hydrazone, 441², 451².
- C₁₂H₇Br₂N₂O *p* - Phenylenediamine, *N* - (3,5 - dibromosalicyl)-, 268².
- C₁₂H₇Br₂N₂O Hydrazine, α - (α - aminonitrobenzal) - β - (2,4 - dibromophenyl)-, and -HCl, 2939².
- C₁₂H₇Br₂O₂ Hydroquinol, 2, o - (3,5 - dibromo - 4 - hydroxybenzyl)-, 1256².
- Pyrocatechol, 4 - (3,5 - dibromo - 4 - hydroxybenzyl)-, 1256².
- Resorcinol, 6 - (3,5 - dibromo - 4 - Hydroxybenzyl)-, 1256².
- C₁₂H₇ClN₂ Acridan, 1-chloro-, 294².
- Benzimidyl chloride, *N*-phenyl-, 2479².
- C₁₂H₇ClNO Nitron, α - (*p* - chlorophenyl)- α - phenyl-, 1259².
- C₁₂H₇ClN₂O₂ Cycloaminotoluquinone, (*p* - chlorophenyl)-, 2649².
- Nitron, *N* - (*p* - chlorophenyl) - α - salicyl-, 1259².
- C₁₂H₇ClN₂O₂ Pyridine, α - 3-chloroacetyl - 1,2 - dihydro - 2-amino-, picrate, 654².
- C₁₂H₇ClN₂O₂ Hydrazine, α - (α - amino - *m* - nitrobenzal) - β - (2,4 - dichlorophenyl)-, and -HCl, 2939².
- C₁₂H₇ClO₂ Benzenesulfonic acid, 2,5 - dichlorothiol-, (*p*-tolyl ester, 3259².
- C₁₂H₇IN₂O₂ Benzaldehyde, nitro-, *p*-iodophenylhydrazone, 3259².
- C₁₂H₇I₂O Ether, o - iodobenzyl o - iodophenyl-, 1423².
- C₁₂H₇NNaO Benzophenone, oxime, Na salt, 2475².
- C₁₂H₇N₂ Acridine, 1 - amino-, and -HCl, 295².
- C₁₂H₇N₂O Anthranilic acid, *N* - (o - amino-phenyl)-, cyclic amide, 294².
- 2 - Phenazinol, methyl-, 643².
- 2(10) - Phenazinone, 10 - methyl-, and chloroplatinate, 643².
- C₁₂H₇N₂O₂ Anhydro - 3 - acetyl amino - 2 - methylcinchoninic acid, 2955².
- 5(4) - Isoxazolone, 3 - naphthylamino-, 471².
- 2-Stilbazole, o'-nitro-, 1573².
- C₁₂H₇N₂O₂ Acenaphthene, 3 - formamido - 2 - nitro-, 651².
- Benzanilide, *p* - nitro-, 260².
- Benzophenone, *p*-nitro-, oxime, 489².
- Nitron, α - (*p* - nitrophenyl) - *N* - phenyl-, 1258².
- C₁₂H₇N₂O₂ 5(7) - Benzothiazolesulfonic acid, 1 - (*p* - aminophenyl)-, 285².
- C₁₂H₇N₂O₂ Benzanilide, 2' - hydroxy - 4' - nitro-, 2340².
- 3,9 - Pyridindole, oxalate, 507².
- C₁₂H₇N₂S Benzothiazole, 1 - (*p* - aminophenyl)-, 285².
- Benzothiazole, 1 - anilino-, 66².
- C₁₂H₇N₂O₂ Anthranilonitrile, *N* - (*p* - amino-phenyl) - 5 - nitro-, and -HCl, 819².
- Benzonitrile, 5 - nitro - 2 - β - phenylhydrazino-, 820².
- 1,2,3 - Benzotriazole, 4(or 6) - methyl - 7 - nitro-1-phenyl, 475².
- 1,2,3 - Benzotriazole - 5 - carboxylic acid, 7 - amino - 1 - phenyl-, and -HCl, 2824², 2825².
- C₁₂H₇N₂O₂ 2,1,3 - Benzotriazole, 2 - (nitro-*p*-anisyl)-, 514².
- C₁₂H₇N₂O₂ Benzaldehyde, hydroxynitro-, *p* - nitrophenylhydrazone, 2040².
- C₁₂H₇N₂O₂ Quinonimine, α - methyl-, picrate, 981².
- C₁₂H₇N₂O (See also Benzophenone.)
Xanthene, 989².
- C₁₂H₇O₂ Benzoic acid, phenyl-, 1703², 2041².
- 3 - Xanthanol, 1568².
- Xanthrol, 989², 1860², 3480².
- C₁₂H₇O₂ (See also Salol.)
 α - Benzoic acid, 5-hydroxy-2-phenyl-, 2657².
- Benzophenone, 4,4' - dihydroxy-, 2710².
- Carbonic acid, di-Ph ester, 2927².
- C₁₂H₇O₂S Fluorenesulfonic acid, 3395².
- C₁₂H₇O₂ Benzoic acid, 5 - hydroxy - 2 - (*p* - hydroxyphenyl)-, 2657².
- 2,7,9,9-Fluorenetetrol, 2657².
- Salicylic acid, salicyl ester, 3124².
- C₁₂H₇O₂ 2,7 - Fluorenedisulfonic acid, 2657².
- C₁₂H₇As Araine, diphenylidenemethyl-, 1132².
- C₁₂H₇AsClN₂O₂ β - [(*p* - Arasonophenyl)carbamyl]benzenediazonium chloride, 979².
- C₁₂H₇AsN₂O₂ Arsanilic acid, *N* - *m* (and *p*)-nitrobenzoyl-, and salts, 979², 3.
- C₁₂H₇AsO₂ Arsanilic acid, (o - carboxyphenyl)-phenyl-, 479².
- Benzencarboxylic acid, o-benzoyl-, 479².
- C₁₂H₇N₂O₂ 3 - Stilbazole, 2 - bromo α -, 1,2 - dihydro - o' - nitro-, and -H₂Br, 1573².
- C₁₂H₇N₂O₂ Hydrazine, α - (α - amino-nitro-

- benzal) - β - (p - bromophenyl)-, and -HCl, 2939^a.
- $C_{13}H_{11}BrO_4$ Umbelliferone, 3-bromo-4-methyl-, Et bicarbonate, 2665^a.
- $C_{13}H_{11}BrN_3$ Benzamide, 2,4 - dibromophenylhydrazones, and -HCl, 2332^a.
- $C_{13}H_{11}BrNO_5$ Addn. compd., m. 116°, of benzanilide and SbBr, 1700^a.
- $C_{13}H_{11}Cl$ Methane, (chlorophenyl)phenyl-, 3269^a.
- $C_{13}H_{11}ClN_2O_2$ Hydrazine, α - (α - amino - m - nitrobenzal) - β - (p - chlorophenyl)-, 2939^a.
- $C_{13}H_{11}ClO$ Benzohydrol, chloro-, 3269^a.
- $C_{13}H_{11}Cl_2NO_2$ Cresol, 4 - (3,5 - dichloro - 4 - hydroxyanilino)-, 2038^a.
- $C_{13}H_{11}Cl_2NO_5$ Addn. compd., m. 112°, of benzanilide and SbCl₅, 1700^a.
- $C_{13}H_{11}Cl_2NO_5$ Addn. compd., m. 99°, of benzanilide and SbCl₅, 1700^a.
- $C_{13}H_{11}IN_3$ Benzaldehyde, p - iodophenylhydrazones, 3259^a.
- $C_{13}H_{11}IN_7O_2$ 2,1 - β - Pyridoquinazol - 11 - one, methiodide, 1282^a.
- $C_{13}H_{11}IN_7O_2$ o -Toluidine, 4-iodo-, picrate, 2192^a.
- $C_{13}H_{11}N$ Acridan, 989^a.
- Agiline, N -benzyl-, 645^a.
- Carbazole, 9-methyl-, 987^a.
- $C_{13}H_{11}NO$ Acenaphthene, 3 - formamido-, 651^a.
- Benzophenone, oxime, chlorostannate, 2652^a.
- Nitrone, N , α -diphenyl-, 463, 1258^a.
- $C_{13}H_{11}NO_2$ Cycloiminotoluquinone, phenyl-, 2649^a.
- Nitrone, α - (p - hydroxyphenyl) - N -phenyl-, 1258^a.
- , N -phenyl- α -salicyl-, 1258^a.
- $C_{13}H_{11}NO_5$ Malonic acid, N - 1 - naphthyl- β -thio-, 471^a.
- Sulfide, benzyl o -nitrophenyl, 1423^a.
- $C_{13}H_{11}NO_5$ Carbanilic acid, N - hydroxy-, Ph ester, 3259^a.
- 2 - Naphthoic acid, 6 - acetamido-, 2820^a.
- $C_{13}H_{11}NO_5$ Benzenesulfonic acid, p - benzamido-, 476^a.
- $C_{13}H_{11}NO_5$ Aconitic acid, anil, Me ester, 3256^a.
- $C_{13}H_{11}NO_5$ Benzenesulfonic acid, m -nitrothiol-, p -tolyl ester, 3259^a.
- Disulfide, o - nitrophenyl p - tolyl (?), 1133^a.
- p - Toluenesulfonic acid, thiol-, o - nitrophenyl ester (?), 1133^a.
- $C_{13}H_{11}NS$ Benzanilide, thio-, 3087^a.
- Benzimidic acid, N -phenylthio-, 2476^a.
- $C_{13}H_{11}N_2O$ 2,1,3 - Benzotriazole, 2 - p - anisyl-, 514^a.
- 5 - Pyrazolone, 3 - naphthylamino-, 471^a.
- $C_{13}H_{11}N_2O_2$ Benzaldehyde, nitro-, phenylhydrazones, 2938^a.
- 1,2,3 - Benzotriazole, 4,7 - dione, 31,71-dihydro - 5 - methyl - 1 - phenyl-, 2649^a.
- Hemipyrocyanin, nitrosamine, 1864^a.
- Hydantoin, 5 - (5 - methyl - 3 - indylmethylene)-, 830^a.
- $C_{13}H_{11}N_2O_2$ Benzaldehyde, 3 - hydroxy - 6 - nitro-, phenylhydrazones, 2331^a.
- $C_{13}H_{11}N_2O_2$ Benzoic acid, 8 - amino - 4 - anilino- δ -nitro-, 2834^a.
- $C_{13}H_{11}N_2O_2$ 2,3 - Pyridothiofen - 3(2) - one, phenylhydrazones, 1278^a.
- $C_{13}H_{11}N_2$ Biphenyl, p -methyl-(?), 2041^a.
- Methane, diphenyl-, 3300^a.
- $C_{13}H_{11}N_2NO_2$ Arsanilic acid, N - benzoyl-, NH_4 salt, 979^a.
- $C_{13}H_{11}BrNO$ Acetamide, N - (5 - bromo - 2 - methyl - 1 - naphthyl)-, 2487^a.
- o - Cresol, α - p - bromoanilino-, 1258^a.
- $C_{13}H_{11}ClN$ Acridine, 5 - chloro - 1,2,3,4 - tetrahydro-, 521^a.
- $C_{13}H_{11}ClNO_5$ m - Benzenesulfonamide, 5'-chloro-6'-hydroxy-, 1562^a.
- $C_{13}H_{11}N$ Acridan, 1-amino-, 295^a.
- Benzaldehyde, phenylhydrazones, 1254^a.
- Formamidine, N , N' - diphenyl-, 476^a.
- 2 - Stilbazole, o' - amino-, and -HCl, 1573^a.
- $C_{13}H_{11}N_2O$ Carbanilide, 642^a.
- 2 - Furanacrolein, phenylhydrazones, 1138^a.
- Hemipyrocyanin, 302^a; salts, 1864^a.
- Urea, s -diphenyl-, 754^a.
- $C_{13}H_{11}N_2O_2$ Acridine, tetrahydronitro-, 521^a.
- Anthranilic acid, N - (o - aminophenyl)-, and -HCl, 294^a.
- Benzylamine, nitro - N - phenyl-, 481^a.
- $C_{13}H_{11}N_2O_2$ Acetamide, N - methylnitro - 1 - naphthyl-, 2487^a.
- 5(10) - Acridone, 1,2,3,4 - tetrahydronitro-, 521^a.
- Cinchonic acid, 3 - acetamido - 2 - methyl-, 2955^a.
- $C_{13}H_{11}N_2O_2$ Pyridine, 1,2 (and 1,4) - dihydro-1 - methyl - 2 (and 4) - p - nitrobenzal-, 2498^a.
- $C_{13}H_{11}N_2O_5$ Benzenesulfonanilide, N - naphthyl-m-nitro-, 642^a.
- $C_{13}H_{11}N_2S$ Carbanilide, thio-, 3085^a.
- Urea, s -diphenylthio-, 754^a.
- $C_{13}H_{11}N_2O$ Semicarbazide, 1 - phenyl - 4 - phenylimino-, 257^a.
- 1,2,3,4 - Tetrazol - 5(4) - one, 2,3 - dihydro-2,3-diphenyl-, 257^a.
- $C_{13}H_{11}N_2OS$ 2,1,3 - Benzotriazole - 2 - p - benzenesulfonic acid, 5 - amino - 6 - methyl-, 2206^a.
- $C_{13}H_{11}N_2O_2$ Aniline, p , p' - methylenebis[3-nitro-, and sulfates, 3267^a.
- $C_{13}H_{11}N_2O_2$ Metachrome brown B, 220^a.
- $C_{13}H_{11}O$ Benzohydrol, 358^a, 1703^a, 1860^a.
- o -Cresol, 6-phenyl-, 270^a.
- Ether, benzyl phenyl, 480^a.
- α,γ,ϵ - Heptatrienaldehyde, δ - phenyl-, 2940^a.
- Phenol, o -benzyl-, 2038^a.
- $C_{13}H_{11}O_2$ Phenol, p , p' - methylenebis-, 2710^a.
- $C_{13}H_{11}O_2$ Chromone, 3 - acetyl - 2,8 - dimethyl-, 1423^a.
- $C_{13}H_{11}O_5$ p - Toluenesulfonic acid, Ph ester, 2483^a.
- $C_{13}H_{11}O_2$ Acetyl deriv., m. 141°, of hydroxy-carboxylic acid from atromentin, 639^a.
- $C_{13}H_{11}O_2$ Chromone, 7 - hydroxy - 3 - methoxy-2 - methyl-, acetate, 517^a.
- Coumagin, 6 - hydroxy - 4 - methyl-, Et bicarbonate, 2665^a.
- Umbelliferone, 4-methyl-, Et bicarbonate, 2665^a.
- $C_{13}H_{11}O_2$ Coumarilic acid, 5 - hydroxy - 2 - methyl-, Et bicarbonate, 2665^a.
- Succinic anhydride, 4-hydroxy- m -anisyl-, acetate, 1701^a.
- $C_{13}H_{11}O_7 + 0.5H_2O$ Benzaldehyde, 2,4,6 - trihydroxy-, triacetate, 2341^a.
- $C_{13}H_{11}O_2$ Tricarballic acid, α - benzoyl-, γ - hydroxy-, 246^a.
- $C_{13}H_{11}AsN_2O_2$ Arsanilic acid, N -(aminobenzoyl)-, 1562^a; and NH_4 salt, 979^a.
- , N -anthranoyl-, 1562^a.
- $C_{13}H_{11}BrO_2$ 3,2 - Cyclopropanedicarboxylic acid, 1 - bromo - 3 - phenyl-, di-Me 2643^a.

- Glutaric acid, α - bromo - γ - hydroxy - β - phenyl-, mono-Et ester, γ -lactone, 2643^a.
 C₁₂H₁₁Br₂NSh Addn. compd., m. 84°, of Ph-CH₂NHPh and SbBr₃, 1700^a.
 C₁₂H₁₁ClN₂O₂ 1 - Pyrazolone, 1 - (*m* - chlorophenyl)- 4 - isopropylidene - 3 - methyl-, 507^a.
 C₁₂H₁₁ClN₂O₂ 1 - Methyl - 2 - *p* - nitrobenzylpyridinium chloride, 2498^a.
 C₁₂H₁₁Cl₂NSh Addn. compd., m. 102°, of PhCH₂NHPh and SbCl₃, 1700^a.
 C₁₂H₁₁Cl₂N₂O₂ Antipyrine, trichloroacetic acid addn. compd., 1140^a.
 C₁₂H₁₁IN₂O₂ 1 - Methyl - 2 - *p* - nitrobenzylpyridinium iodide, 2498^a.
 C₁₂H₁₁N Acridine, tetrahydro-, and salts, 521^a. Benzylamine, *N*-phenyl-, 766^a, 2194^a, 2645^a. Diphenylamine, *N*-methyl-, 1362^a.
 C₁₂H₁₁N₂O₂ Acetamide, *N* - (methylmaphthyl)-, 2487^{a,4,5}, 2820¹.
 5(10) - Acridone, 1,2,3,4 - tetrahydro-, and salts, 521^a.
o-Anisidine, α -phenyl-, and -HCl, 1423^a.
 C₁₂H₁₁NOS α -Toluenesulfanilide, 257^a.
 C₁₂H₁₁NO₂ 2 - Naphthylamine, *N* - acetylmethoxy-, 197^a, 498^a.
 C₁₂H₁₁NO₂ 2 - Indolecarboxylic acid, 3 - formyl-5-methyl-, Et ester, 830^a.
 3 - Indolepropionic acid, β -keto-, Et ester, 299^a.
 C₁₂H₁₁NO₂S 1 - Propanesulfonic acid, 3 - (2-naphthylimino)-, 2328^a.
 C₁₂H₁₁NO₂S Alanine, *N* - [(1 and 2) - naphthylsulfonyl]-, and NH₄ salt, 972^{a,4}.
 C₁₂H₁₁NO₂ 3 - Pyrrolidineacetic acid, 3 - hydroxy - 2,5 - diketo - 1 - phenyl-, Me ester, 3256^a.
 C₁₂H₁₁NO₂ Succinic acid, α - (hydroxymethoxy)- α - [(phenylcarbamyl)methyl]-, γ -lactone, 3255^a.
 C₁₂H₁₁NO₂ Benzaldehyde, 3 - hydroxy - 6 - nitro-, tri-Ac deriv., 2331^a.
 C₁₂H₁₁N₂S Aniline, *o* - (benzylmercapto)-, 1423^a.
p - Toluenesulfenamide, 1655^a.
 C₁₂H₁₁N₂S 2 - Isothiazoloquinolinone, 10 - ethyl-10,10-dihydrothio-, 289^a.
 C₁₂H₁₁N₂OPS Benzodiazphospholium, *p* - tolyloxy-*P*-thiodihydro-, 2325^a.
 C₁₂H₁₁N₂ Guanidine, diphenyl-, 2425^a.
 C₁₂H₁₁N₂O Phenol, *p* - (2,6 - dimethyl - 3 - pyridylazo)-, and -HCl, 2955^a.
 C₁₂H₁₁N₂O₂ Aniline, *N* - (2,6 - dimethyl - 4 - pyridyl) - *o* - nitro-, 1280¹.
 Diphenylamine, 2(or 6) - amino - 3 - methyl-6(or 2)-nitro-, 475^a.
 • Hydantoin, 5 - (5 - methyl - 3 - indylmethyl)-, 830^a.
 C₁₂H₁₁N₂O₂S 1,3,4 - Thiadiazole - 2 - mercaptan, 4 - acetyl - 4,5 - dihydro - 5 - *p* - tolylimino-, acetyl deriv., 988^a.
 C₁₂H₁₁AsCl₂HgI₂ Tris(β - chlorovinyl)methyl-arsonium iodide, C₆H₅HgI compd., 3250^a.
 C₁₂H₁₁As₂O₂ Arsanilic acid, *N*, *N'* - carbonylbis-, 979^a.
 C₁₂H₁₁BrNO₂ Quinoline, 8 - bromo - 5,6 - dimethoxy - 2,4 - dimethyl-, and -HCl, 2344^a.
 C₁₂H₁₁BrNO₂S Malonanilic acid, α - acetyl- β -bromo- β -thio-, Et ester, 471^a.
 C₁₂H₁₁Br₂O₂ Glutaric acid, α , γ - dibromo- β -phenyl-, di-Me ester, 2643^a.
 C₁₂H₁₁ClNO₂S Malonanilic acid, α - acetyl- β -chloro- β -thio-, Et ester, 471^a.
 C₁₂H₁₁ClNO₂ Tyrosyl chloride, *N*, *O* - dicarboxymethoxy-, 1208^a.
 C₁₂H₁₁Cl₂O₂N₂S Melanestannonic acid, pentachloroacetate, 465^a.
 C₁₂H₁₁IN 4 - Benzyl - 1 - methylpyridinium iodide, 2498^a.
 C₁₂H₁₁INO₂S Malonanilic acid, α - acetyl - β -iodo - β - thio-, Et ester, 471^a.
 C₁₂H₁₁N₂ Acridine, aminotetrahydro-, and salts, 521^a.
 Aniline, *p*, *p'* - methylenebis-, 3267^a.
 C₁₂H₁₁N₂O 5(10) - Acridone, amino - 1,2,3,4-tetrahydro-, and -HCl, 521^{a,3}.
 Base from the methiodide of (*p*-aminophenyl)-diphenyloxazole, and chloroplatinate, 2667^a.
 3,9 - Pyridindole, 3 - acetyl - 1,2,3,4 - tetrahydro-, 507^a.
 2 - Pyridineethanol, α - (*o* - aminophenyl)-, and -HCl, 1573^{a,4}.
 C₁₂H₁₁N₂O₂S 3 - Pyroglutamic acid, 2-formyl - 4,5 - dimethyl-, Et ester, rhodanine deriv., 3270^a.
 C₁₂H₁₁N₂O₂ Anthranilic acid, *N* - cyclohexylidene - 4 (and 5) - nitro-, 521^{a,3}.
 ---, *N* - (2 - nitrocyclohexylidene)-, 521^a.
 1,2 - Propanedione, 1 - α -phenyl-, dioxime diacetate, 2627^a.
 C₁₂H₁₁N₂O₂S 3,9 - Pyridindole, Me sulfate, 507^a.
 C₁₂H₁₁N₂O₂ Compd. m. 190°, from tryptophan, 1731^a.
 1 - Hydantoinacetic acid, 5 - β - hydroxy-benzyl - 3 - methyl-, 436^a.
 C₁₂H₁₁N₂O₂S *o* - Toluidine, 4 - nitro-, benzenesulfonate, 651^a.
 C₁₂H₁₁N₂ Aniline, *N*, *N'* - dimethyl - 4 - pyridyl-azo-, dinitrate, 70^a.
 C₁₂H₁₁N₂O Benzophenone, 2,4,2',4' - tetra-amino-, 2955^a.
 Carbohydrazide, α , β - diphenyl-, 256^a.
 C₁₂H₁₁N₂O₂ Cyclohexanecitrile, 2-keto - *p*-nitrophenylhydrazone, 1262^a.
 C₁₂H₁₁N₂O₂ Antipyrine, 4 - isonitrosoacetamido-, 2646^a.
 C₁₂H₁₁N₂O₂ $\Delta^{1,2}$ - Pentadienylamine, *N* - ethyl- ϵ - (dinitrophenylimino)-, perchlorate, 1267^a.
 C₁₂H₁₁N₂O₂ Picemic acid, α - keto - 2,4 - dinitrophenylhydrazone, 1559^a.
 C₁₂H₁₁N₂O₂ Oxazole, 5 - ethoxy - 2,4 - dimethyl-, picrate, 2051^a.
 C₁₂H₁₁N₂S Carbanilide, *p*, *p'* - diaminothio-, di-HCl, 1250^a.
 Carbohydrazide, α , β - diphenylthio-, 223^a.
 C₁₂H₁₁O₂ Naphthoic acid, dihydro-, Et ester, 1269^a.
 C₁₂H₁₁O₂ 2 - Naphthoic acid, 3,4 - dihydro-1-hydroxy-, Et ester, 261^a.
 C₁₂H₁₁O₂S 2 - Naphthalenesulfonic acid, 6-methyl-, Et ester, 2819^a.
 C₁₂H₁₁O₂ Δ^1 - 3 - Pentenol, acid phthalate, 2331^{a,4}.
 C₁₂H₁₁O₂ 1,2 - Cyclopropanedicarboxylic acid, 1-ethoxy-3-phenyl-, 2643^a.
 Malonic acid, acetylphenyl-, di-Me ester, 1560^a.
 Phthalonic acid, 4,6 - dimethyl-, di-Me ester, 483^a.
 Terephthalonic acid, 2,6 - dimethyl-, di-Me ester, 482^a.
 C₁₂H₁₁O₂ 3,6 - Benzofurandiol, 1,3 - dihydro-, 5-methoxy-, diacetate, 484^a.

- C₁₂H₁₁O₇** Benzaldehyde, 8,4 - bis(carbethoxy-oxy)-, 769.
Citric acid, monobenzyl ester, p 2673¹.
C₁₂H₁₁AgClNO₄ Carbamic acid, ethylhydroxy-, Pr ester, *p*-chlorobenzoate, Ag salt, 970¹.
C₁₂H₁₁BrO₄ Glutaric acid, α - bromo - β - phenyl-, di-Me ester, 2643².
C₁₂H₁₁BrO₄ Malonic acid, bromo(*p* - phenoxybutyl)-, 471⁴.
C₁₂H₁₁Hg₂NO₄ *m* - Acetotoluides, bis(acetoxy-mercuri)-, 49⁸, 50¹.
C₁₂H₁₁NO Addn. compd. of phenol and *p*-toluidine, 3200².
C₁₂H₁₁NO₂ Carbanilic acid, Δ^1 - cyclohexenol ester, 1857⁷.
C₁₂H₁₁NO₂ Isoquinolinedione, 4,4 - diethyl-, 375².
Quinoline, dimethoxy - 2,4 - dimethyl-, and -HCl, 2344^{2,4,5}.
C₁₂H₁₁NO₂S Toluidine, benzenesulfonate, 651².
C₁₂H₁₁NO₄ Phthalimide, 4-ethoxy-*N*-ethyl-5-methoxy-, 2959⁷.
Valeric acid, δ - *o* - formamidobenzoyl-, 3263².
C₁₂H₁₁NO₂S *p* - Anisidine, benzenesulfonate, 651².
C₁₂H₁₁NO₄ 2 - Pyrroleacrylic acid, α ,4 - dicarboxy - 3,5 - dimethyl-, mono-Et ester, and Ag salts, 2663², 2664¹.
C₁₂H₁₁NO₄ Tyrosine, *N*,*O* - dicarbomethoxy-, 1248².
C₁₂H₁₁N₂O₂ Antipyrine, 4-acetamido, 2040⁷.
C₁₂H₁₁N₂O₂ 2 - Propanone, 1,3 - dihydroxy-*p* - nitrophenylhydrazone, diacetate, 245¹.
C₁₂H₁₁N₂O₂S Imidazole, 2 - ethylmercapto-1,4 - dimethyl-, picrate, 1709².
C₁₂H₁₁N₂O₂ Piperidazine - *N* - carboxylic acid, endomethylene, Me ester, picrate, 2499¹.
C₁₂H₁₁BrNO₂ Δ^1 - 2 - Pentenone, 4 - (2 - bromo-4,5 - dimethoxyanilino)-, 2344².
C₁₂H₁₁CINO₄ Carbamic acid, ethylhydroxy, Pr ester, *p*-chlorobenzoate, 970¹.
C₁₂H₁₁CIN₂O (and 2) - Acetonaphthone, α -chloro - 5,8,7,8 - tetrahydro-, semicarbazone, 1273¹.
C₁₂H₁₁Cl₂CrNO₄ 1385².
C₁₂H₁₁INO 3 - Iodoxy - 1,2 - dimethylquinolinium iodide, 1278².
1 - Ethyl - 8 - methoxyquinaldinium iodide, 2668².
C₁₂H₁₁IN₂O Antipyrine, methiodide, C₁₂H₁₁ addn. compd., 1403¹.
C₁₂H₁₁N₂O₂ Acridine, octahydro-, and -HCl, 522¹.
Hydantoin, 5 - butyl - 5 - phenyl, 1253¹, 5 - isobutyl - 5 - phenyl, 1253¹.
C₁₂H₁₁N₂O₂ Barbituric acid, 5 - allyl - 5 - Δ^2 cyclohexenyl-, P 3566⁷.
C₁₂H₁₁N₂O₄ Pimelic acid, α - keto-, phenylhydrazones, 1559².
C₁₂H₁₁N₂O₄ Alanine, *N* - (*N* - carboxytyrosyl)-, 1248².
Aspartic acid, *N* - tyrosyl-, 1248².
Carbamic acid, ethylhydroxy, Pr ester, *m* (and *p*)-nitrobenzoate, 970¹.
C₁₂H₁₁N₂O₂ Antipyrine, 4 - glycyllamino-, 2646².
C₁₂H₁₁N₂O₄ Δ^1 - Pyrazoline, 1 - carbamyl - 3,5,5-trimethyl-, picrate, 2666².
C₁₂H₁₁O₇ γ - Pentenophenone, α , α - dimethyl-, 1134¹.
-, α -ethyl-, 1134¹.
C₁₂H₁₁O₂ Cinnamic acid, ρ - β - dimethyl, Et ester, 277².
2,4 - Pentanedione, 3 - phenethyl-, 1269².
- C₁₂H₁₁O₄** Δ^1 - 3 - Hexenone, 1 - (4 - hydroxy-*m*-anisyl)-, 2943².
Hydrocinnamic acid, *o* - acetyl-, Et ester, 1569⁴.
C₁₂H₁₁O₄ Carbonic acid, (α - methoxystyryl), Et ester, 2816^{2,3}.
Homoterephthalic acid, 2,6 - dimethyl-, di-Me ester, 482².
Lactic acid, α -toluate, 1407⁴.
C₁₂H₁₁O₄ Malonic acid, (δ - phenoxybutyl)-, 471².
C₁₂H₁₁O₇ Isophthalic acid, 2,4,6 - trimethoxy-, di-Me ester, 640².
Pseudophloroglucinoldicarboxylic acid, *C*-monomethyl-, di-Et ester, 646¹.
C₁₂H₁₁BrN₂O₂ Malonamide, α - bromo - *N*-isopropyl - *N'* - *p*-tolyl-, 1697¹.
C₁₂H₁₁BrN₂O₂S Δ^2 - Pyrazoline, 1 - (*p* - bromophenylsulfonyl) - 5 - isopropyl - 3 - methyl-, 2666².
C₁₂H₁₁Br₂Cl *p* - Cymene, 2 - (β , γ - dibromo- γ - chloropropyl)-, 2645².
C₁₂H₁₁Cl Cumene, *p* - δ - chlorobutenyl-, 2645².
p - Cymene, 2 - γ - chloroallyl-, 2645².
C₁₂H₁₁IN 1 - Allyl - 2 - propylindazolium iodide, 3091².
C₁₂H₁₁N Acridine, octahydro-, 522¹.
C₁₂H₁₁NO γ - Pentenophenone, α - ethyl-, oxime, 1134¹.
Penteno - *p* - toluide, β - methyl-, 1695².
C₁₂H₁₁NO₂ Acetoacetamide, β - benzyl - β - ethyl-, 376¹.
1 - Ethyl - 8 - methoxyquinaldinium hydroxide, and salts, 2668².
2 - Naphthylamine, *N* - acetyl - 5,6,7,8-tetrahydro - 7 - methoxy-, 498¹.
C₁₂H₁₁NO₂ Acetanilide, 2 - allyl - 4,5 - dimethoxy-, 2344².
Butylanilide, α - hydroxy - α - methyl-, acetate, 2643².
Malonic acid, α - phenethyl-, Et ester, 471².
 Δ^2 2 - Pentenone, 4 - (dimethoxyanilino)-, 2344^{2,4,5}.
C₁₂H₁₁NO Carbamic acid, ethylhydroxy, Pr ester, benzoate, 969².
Oximidocarbonic acid, Et Pr ester, Bz deriv., 970².
Pyrroleacrylic acid, 5 - carbethoxy - 2 - ethol-4-methyl, 1429².
-, 4 - carboxy - 3,5 - dimethyl-, Et Me ester, 2663².
C₁₂H₁₁NO₂ 1,2,3 - Cyclopropanetricarboxylic acid, 1 - cyano-, tri-Et ester, 246².
Pyrroleacrylic acid, 4 - (β , β -dicarboxyethyl)dimethyl-, mono-Et ester, 2336², 2823².
C₁₂H₁₁N₂O (See also *Pyromellone*.)
Cyclohexanone, 2 - phenylsemicarbazone, 478².
Mesityl oxide, phenylsemicarbazone, 3485².
C₁₂H₁₁N₂O₂ Acetone, 4 - (carbethoxyphenyl) semicarbazone, 1130^{2,2}.
C₁₂H₁₁N₂O₄ Addn. compd., *m*. 140-3², of *p*-aminobenzoic acid and 1,4 - dimethyl-2,5 - piperazinedione, 2038².
C₁₂H₁₁N₂O₂S Δ^2 - Thiazoline, 5 - ethoxy - α -methyl - 2 - methylamino-, picrate, 1709².
C₁₂H₁₁N₂ Acridine, aminooctahydro-, and -HCl, 521².
C₁₂H₁₁N₂O Esceroline, 1140².
Piperidine, 1 - (*N* - phenylglyl)-, 3083².

- C₁₂H₁₃N₂O₂ Acetamide, α - benzamido - *N*, *N* - diethyl-, 2052^a.
Cycloheptanecetic acid, α , 1 - dicyano-, Et ester, 268^a.
Malonamide, *N* - isopropyl - *N'* - *p* - tolyl-, 1697¹.
C₁₂H₁₁N₂O₂ Δ^1 - Pyrazoline, 5 - isopropyl - 4 - 3 - methyl - 1 - (phenylsulfonyl)-, 2666^a.
C₁₂H₁₁N₂O₂ Barbituric acid, 5 - ethyl - 5 - Δ^1 - methylcyclohexenyl-, P 3566^a.
1 - Isoquinolinemethylamine, 1, 2, 3, 4 - tetrahydro - 8 - methoxy - 2 - methyl - 6, 7 - methylenedioxy-, and di-HCl, 2669¹.
C₁₂H₁₁N₂O₂ 2 - Propanone, 1, 3 - diacetamido-, phenylhydrazone, 1827^a.
C₁₂H₁₁N₂O₂ Hydrocinnamaldehyde, *o*-acetyl-, disemicarbazone, 2202¹.
C₁₂H₁₁O₂ Cyclohexanecarbinol, α -phenyl-, 2636^a.
Eranthophenone, 1899¹.
 Δ^1 - 2 - Heptenol, 2 - phenyl-, 1247^a.
Pyran, tetrahydro - 2 - phenethyl-, 288^a.
C₁₂H₁₁O₂ Curcuminic acid, Et ester, 277^a.
3 - Hexanol, 1 - phenyl-, formate, 2331^a.
3 - Pentanol, 1 - phenyl-, acetate, 2331^a.
Propionic acid, α - methyl - γ - phenylpropyl ester, 2331^a.
 α -Toluic acid, α -ethyl-*p*-methyl-, Et ester, 277^a.
Valerophenone, *p*-methoxy-, 267¹.
C₁₂H₁₁O₂ 3 - Hexanone, 1 - (4 - hydroxy - *m*-anisyl)-, 2944¹.
2 - Naphthoic acid, decahydro - 1 - hydroxy-, 262¹.
3 - Pentanone, 1 - (3, 4 - dimethoxyphenyl)-, 2943^a.
C₁₂H₁₁O₂S Glucoside, α - benzylthio-, 2056^a.
C₁₂H₁₁O₂ *d* - Glucose, 3 - benzyl-, 2035¹.
C₁₂H₁₁O₂ See *Salicin*.
C₁₂H₁₁BrN₂O₂ Benzoic acid, 4 - amino - 2 - chloro-, β - diethylaminoethyl ester, 2332^a.
C₁₂H₁₁BrO₂ 3 - Camphanepropionic acid, bromo- Δ keto-, 2818^a.
C₁₂H₁₁ClO₂ 3 - Camphanepropionyl chloride, 2-keto-, 2818^a.
C₁₂H₁₁IN₂ 1, 2 - Dipropylindazolium iodide, 3091^a.
Phenazine, octahydro-, methiodide, 2499^a.
C₁₂H₁₁N Indanamine, *N*, *N* - diethyl-, 1520^a.
C₁₂H₁₁NO 5(10) - Acridone, decahydro-, 521^a.
Caproamide, γ -methyl-, 464¹.
Piperidine, 1 - β - phenoxyethyl-, and salts, 1424¹.
C₁₂H₁₁NO₂ Benzamide, *N* - (β - ethyl - β - hydroxybutyl)-, 635¹, 3254¹.
Quinoline, 1, 2, 3, 4 - tetrahydrodimethoxy-2, 4-dimethyl-, 2344¹, 4^a.
C₁₂H₁₁NO₂ 2 - Furanacrylic acid, β - diethylaminoethyl ester, -HCl, 653¹.
3 - Pentanone, 1 - (3, 4 - dimethoxyphenyl)-, oxime, 2943^a.
C₁₂H₁₁NO₂ 3, 4 - Pyrroledicarboxylic acid, 1, 2, 5-trimethyl-, di-Et ester, 1420^a.
3 - Pyrrolepionic acid, 5 - carbethoxy - 2 - ethyl-4-methyl-, 1429^a.
C₁₂H₁₁NO₂ Curcumone, semicarbazone, 277^a.
C₁₂H₁₁NO₂ Acetophenone, 2 - isopropoxy - 5-methyl-, semicarbazone, 1406^a.
Eranthaldehyde, α - 2 - fural-, semicarbazone, 1189^a.
C₁₂H₁₁NO₂ 3, 4 - Pyrroledicarboxylic acid, 1-carbamido - 2, 5 - dimethyl-, di-Et ester, 1420^a.
C₁₂H₁₁N₂O Acetophenone, α , 3, 4, 5 - tetramethoxy-, semicarbazone, 1141^a.
C₁₂H₁₁N₂O₂ *as* - Triazine - 6 - α - adipic acid, 2, 3, 4, 5 - tetrahydro - 3, 5 - diketo-(?), di-Et ester, 1559^a.
C₁₂H₁₁O₂ + H₂O Aucubin, 93¹.
C₁₂H₁₁O₂ Cyclohexene, 3 - cyclohexylidene - 2-methyl-, 2942¹.
n-Heptane, phenyl-, 1222^a.
C₁₂H₁₁AsI Allylmethylphenylpropylarsonium iodide, 1408^a.
C₁₂H₁₁BrNO₂ Hydrocinnamic acid, di-Et ammonium salt, 2622¹.
C₁₂H₁₁IN Compd. from amine from 3, 5 - toluenediacetonitrile, and chloroplatinate, 1564^a, 1565¹.
C₁₂H₁₁INO Trimethyl - [γ - (3, 4 - methylenedioxyphenyl)propyl]ammonium iodide, 2652^a.
C₁₂H₁₁N₂O₂S *d*-Glu *p*-tolylsulfonylhydrazide, 260^a.
Sugar from *Ha neli* tannin, *p* - tolylsulfonylhydrazide, 260^a.
C₁₂H₁₁N₂O₂S Gluconic acid, *p* - tolylsulfonylhydrazide, 261¹.
Hexonic acid, *p* - tolylsulfonylhydrazide, 260^a.
C₁₂H₁₁N₂O₂ Δ^1 - Cyclohexenone, 5 - furyl - 3-methyl-, semicarbazide - semicarbazone, 3484¹.
C₁₂H₁₁O (See also *Ionone*.)
Anisole, *p*-hexyl-, 267¹.
Bornylene, 3-propionyl-, 1263¹.
C₁₂H₁₁O Benzaldehyde, diisopropylacetal, 1694¹.
3 - Camphanepropionic acid, 2 - hydroxy-, lactone, 2818^a.
2, 3 - Pentanediol, 3 - ethyl - 2 - phenyl-, 1701^a.
Propiolic acid, (3 - cyclohexylbutyl)-, 3476^a.
C₁₂H₁₁O₂ 3 - Camphanepropionic acid, 2-keto-, 2818^a.
2 - Naphthoic acid, decahydro - 1 - keto-, Et ester, 1270^a.
C₁₂H₁₁O₂S Benzenesulfonic acid, 2 (or 5)-hexyl-5(or 2)-methoxy-, 267¹.
C₁₂H₁₁O₂ 1, 2, 4 - Butanetricarboxylic acid, 2-hydroxy - 3, 3 - dimethyl-, γ - lactone, di-Et ester, 2329^a.
C₁₂H₁₁S₂ Propane, 1, 1 - bis(ethylmercapto)-1-phenyl-, 265^a.
C₁₂H₁₁ClN₂O₂ See *Procaine*.
C₁₂H₁₁I₂N Tetraallylammonium iodide, CHI₃ addn. compd., 1403¹.
C₁₂H₁₁NO Bornylene, 3-propionyl-, oxime, 1263¹.
3 - Pentanol, 3 - (α - aminophenethyl)-, 635^a.
C₁₂H₁₁NO₂ 3 - Camphanepropionamide, 2 - keto-, 2818^a.
Triethylamine, β - (*p* - anisylxy)-, 2977^a.
C₁₂H₁₁NO₂S Bornylacetic acid, (carbamylmethyl) ester, 56^a.
C₁₂H₁₁NO₂S Benzenesulfonamide, 2(or 5)-hexyl-5(or 2)-methoxy-, 267¹.
C₁₂H₁₁NO₂ Bisacetonequinamide, 2042^a.
C₁₂H₁₁NO₂ Bornylene, 3 - acetyl-, semicarbazone, 1263^a.
Curcumone, semicarbazone, 74¹.
C₁₂H₁₁NO₂ Acetate, m. 206^a, of base made from chemopodium oil, 2942^a.
C₁₂H₁₁AgN₂O₂ Urea, *s* - bis(α - ethyl - α - hydroxybutyl)-, Ag salt, 1130¹.
C₁₂H₁₁Br₂O₂ Glutaric acid, α , γ - dibromo - α -ethyl - β , β - dimethyl-, di-Et ester, 1697^a.
C₁₂H₁₁IN Benzyltriethylammonium iodide, 1403¹.

- C₁₁H₂₁IP Benzyltriethylphosphonium iodide, 1403⁴.
- C₁₁H₂₁N₂ Hydrazine, α - heptyl - β - phenyl-, 2478¹.
- C₁₁H₂₁N₂O₄ 1,2 - Pyridazinedicarboxylic acid, 1,2,3,6 - tetrahydro - 3,3,5 - trimethyl-, di-Et ester, 2499¹.
- C₁₁H₂₁O Camphane, 3-propionyl-, 1264¹.
Cyclohexanol, 2 - cyclohexylidene - 1 - methyl-, 2941¹.
Ketone, 3 - isopropenyl - 2,2,3 - trimethylcyclopentyl methyl, 2656².
 Δ^1, α - 5 - Nonadienone, 4,4,6,6 - tetramethyl-, 1134².
Trimethylenecamphane oxide, 2818⁷.
- C₁₁H₂₁O₂ Borneol, propionate, 2657².
3 - Camphane-carboxylic acid, Et ester, 1263¹.
 Δ^1, α - Cyclohexanecarboxylic acid, 5 - isopropyl-, α ,2-dimethyl-, 2030².
Cyclohexanecarboxylic acid, 2 - cyclohexyl-, and salts, 1702².
Fenchyl alcohol, propionate, 2657².
Isoborneol, propionate, 2657².
- C₁₁H₂₁O₃ 3 - Camphane-carboxylic acid, 2 - hydroxy-, Et ester, 1263¹.
3 - Camphane-propionic acid, 2 - hydroxy-, isomers, 2818⁷.
Cutinic acid, 3291⁷.
- C₁₁H₂₁O₄ Fructose, diacetone-, Me ether, 2504¹.
1,1,2 - Propanetricarboxylic acid, 2 - methyl-, tri-Et ester, 1408².
- C₁₁H₂₁BrO Borneol, 3 - (γ - bromopropyl)-, 2818⁷.
- C₁₁H₂₁NO Camphane, 3 - propionyl-, oxime, 1264¹.
Ketone, 3 - isopropenyl - 2,2,3 - trimethylcyclopentyl methyl, oxime, 2656².
- C₁₁H₂₁NO₂ Carbamic acid, dimethylthiono-, bornyl ester, 57².
—, ethylthiono-, bornyl ester, 57².
- C₁₁H₂₁NO₃ Oxazole, 2 - sec - butyl - 5 - ethoxy-4-isobutyl-, 2051¹.
- C₁₁H₂₁N₂O Camphane, 3 - acetyl-, semicarbazone, 1264¹.
- C₁₁H₂₁N₂O₂ Cyclopentane, 1,3 - diacetyl - 1,2,2-trimethyl-, semicarbazone, 2656².
- C₁₁H₂₁N₂O₃ Malonic acid, acetonylethyl-, di-Et ester, semicarbazone, 3480².
- C₁₁H₂₁ Bicyclohexyl, 2-methyl-, 2942¹.
- C₁₁H₂₁N₂O Cuscohygrine, and salts, 1282².
- C₁₁H₂₁O Cyclohexanol, 2 - cyclohexyl-1-methyl-, 2941¹.
- C₁₁H₂₁O₂ 3 - Camphane-propanol, 2 - hydroxy-, 2818⁷.
Ketone, 3 - (α - hydroxyisopropyl) - 2,2,3-trimethylcyclopentyl methyl, 2656².
- C₁₁H₂₁O₃ Cyclohexanecarboxylic acid, α -hydroxy-, Am ester, 982².
- C₁₁H₂₁O₄ Malonic acid, bis(β - methylbutyl)-, 464¹.
- C₁₁H₂₁O₁₁ Gentiobioside, α -methyl-, 1250².
Glucoside, 6(β) - β - glucosido - α - methyl-, 250².
Maltoside, methyl-, 2034².
- C₁₁H₂₁O₁₂ Nonoxymethylene, diacetate, 1245².
- C₁₁H₂₁I₂N Dialyldipropylammonium iodide, CHI₃ addn. compd., 1403¹.
- C₁₁H₂₁NO₂ Leucine, N - α - methylbutyl-, Et ester, 2051¹.
- C₁₁H₂₁NO₄ Malonic acid, (β - dimethylaminoethyl)ethyl-, di-Et ester, 1560².
- C₁₁H₂₁ 7-Dodecene, 3-methyl-, 2474¹.
4-Nonene, 5-butyl-, 1995¹.
- C₁₁H₂₁I₂N Indole, 1 - butylperhydro-, quaternary methiodide, 1862².
- C₁₁H₂₁N₂O Cuscohygrine, dihydro-, and salts, 1282².
- C₁₁H₂₁O Cyclohexanecarboxylic acid, 5-isopropyl-, β ,2-dimethyl-, 2030².
Tridecanone, 1692², 2807².
- C₁₁H₂₁ Nonane, 5-butyl-, 1695¹.
- C₁₁H₂₁Al Allylethyl-diisobutylarsonium iodide, 1403².
- C₁₁H₂₁I₂N 2 - Isobutylcyclohexyltrimethylammonium iodide, 1862².
- C₁₁H₂₁O 3-Dodecanol, 2-methyl-, 2474¹.
5-Nonanol, 5-butyl-, 1695¹.
- C₁₁H₂₁O₂ Enanthaldehyde, diisopropylacetal, 1694¹.
- C₁₁H₂₁Br₄I₂N Tetrapropylammonium iodide, CHI₃ addn. compd., 1403¹.
- C₁₁H₂₁I₂N Tetrapropylammonium iodide, CHI₃ addn. compd., 1402².
- C₁₁H₂₁N₂O₄ Base from amniotic fluid, 3302².
- C₁₁H₂₁Br₂O Anthraquinone, 2,3 - dibromo-, 2663¹.
- C₁₁H₂₁Br Anthracene, 2,3,9,10 - tetrabromo-, 2663¹.
- C₁₁H₂₁Br₂N₂O₂ 3,3' - Bi[1,4 - imidazopyridin-2-ol], 6,8,6',8' - tetrabromo-(?), 1276².
- C₁₁H₂₁Br₂N₂O₂ 9,10 - Dihydro - 9,10 - diketophenanthrenetetrazonium perbromide, 1569².
- C₁₁H₂₁Cl₃N₂O Anthraquinone, 1 - amino - 2,3,4-trichloro-, P 300².
- C₁₁H₂₁N₂O Anthracenetriene, diazo-, 3270^{1,2}.
- C₁₁H₂₁N₂O₂ Phenanthrenequinone, ditriazo-, 1569².
- C₁₁H₂₁O₄ 2,3,9,10 - Anthracenetetrone, 2822².
- C₁₁H₂₁O₅ Ellagic acid, 1324⁴, 3145².
- C₁₁H₂₁BrCl₂O Anthrone, 10 - bromo - 1,5 - dichloro-, 2489².
- C₁₁H₂₁BrO Anthraquinone, bromo-, 2663¹.
- C₁₁H₂₁Br Anthracene, 2,9,10 - tribromo-, 2663¹.
- C₁₁H₂₁Br₂N₂O₂ 9,10 - Dihydro - 9,10 - diketophenanthrenediazonium perbromide, 1270².
- C₁₁H₂₁ClO Anthraquinone, 2-chloro-, 2335².
- C₁₁H₂₁Cl₂N₂O Anthracene, dichloronitro-, 60², 61¹.
Anthraquinone, 1-aminodichloro-, P 300².
- C₁₁H₂₁Cl₂N₂O Anthrone, 1,5 - dichloro - 10 - nitro-, 2490².
- C₁₁H₂₁ClO Anthrone, 1,5,10 - trichloro-, 2490².
- C₁₁H₂₁NO Anthraquinone, nitro-, 308², 2976¹.
- C₁₁H₂₁N₂O₂ Anthraquinone, 1(and 2)-triazol-, 2202^{2,3}.
Phenanthrenequinone, 3-triazo-, 1270².
- C₁₁H₂₁NaO₂ Δ^1, α - 5 - Nonadienone, Bi[1,4 - imidazopyridin-2-one](?), Na deriv., 1863².
- C₁₁H₂₁AgO₃ Disalicylicboric acid, Ag salt, 2179¹.
- C₁₁H₂₁BeO₃ Disalicylicboric acid, K salt, 2179¹.
- C₁₁H₂₁BN₂O₃ Disalicylicboric acid, Na salt, 2179¹.
- C₁₁H₂₁BrCl Anthracene, 9(or 10) - bromo - 1-chloro-, 60².
- C₁₁H₂₁BrN₂O Indazole, 3 - bromo - (σ - nitrobenzoyl)-, 512².
- C₁₁H₂₁BrCl Anthracene, 9,10 - dibromodichloro-, 9,10-dihydro-, 60^{2,3}.
- C₁₁H₂₁Br₂N₂O Benzoic acid, 4,4' - azobis[2-bromo-, 2332².
- C₁₁H₂₁Br₂N₂S 1,1' - Bibenzothiazole, tetrabromodisulfide, 2666².
- C₁₁H₂₁Br Anthracene, hexabromotetrahydro-, 2663¹.

- C₁₄H₈ClNO₂** Anthracene, chloro - 9(or 10)-nitro-, 608^a.
C₁₄H₈ClN 3 - Indazolenitrile, 2 - (*p* - chlorophenyl)-, 2339^a.
 —, 5 - chloro - 2 - phenyl-, 2339^a.
C₁₄H₈ClNO Diphenazineoxazine, 8-chloro-, 1284¹.
 3 - Indazolenitrile, 2 - (*p* - chlorophenyl)-, 1-oxide, 2339^a.
 —, 5 - chloro - 2 - phenyl-, 1 - oxide, 2339^a.
C₁₄H₈Cl₂N Phenanthrene, 9,10-dichloro-, 2334^a.
C₁₄H₈Cl₂N 5,11 - Fluoravine, 3,8 - dichloro-, 1284¹.
C₁₄H₈Cl₂O Benzoyl peroxide, *p*, *p'* - dichloro-, 1564¹.
C₁₄H₈N₂O 6(2) - *meso* - Anthrapyrazolone, 1275¹.
C₁₄H₈N₂O₂ Diphenazineoxine, 1284¹.
 Diphenidoxazine, 1284¹.
C₁₄H₈N₂O Anthranil, *N* - benzoyl - 4 - nitro-, 646⁷.
 2,4,1 - Benzoxaz-1-one, 6-nitro-3-phenyl-(?), 646⁷.
 Pseudoisatin, 6 - nitro - 1 - phenyl-, and salts, 646⁷.
 Quinhydrone, dicyano-, 2161¹.
C₁₄H₈N₂O₂ Bisaccharin, 1857^a.
C₁₄H₈N₂O₂ Benzoic acid, *o* - (dinitrobenzoyl)-, 2950^a.
C₁₄H₈N₂O₂ Benzoyl peroxide, *m*, *m'* - dinitro-, 1564¹.
C₁₄H₈N₂S 1,1' - Bibenzothiazole, 2666¹.
C₁₄H₈N₂O See *Jaïne*.
C₁₄H₈N₂O₂ Δ^{2,2'}(3,3') - Bi - 7 - iso - 1,7 - pyrrolopyridine - 3,3' - dione(?), 281¹.
 Δ^{2,2'}(3,3') - Bi - 1,7 - pyrrolopyridine - 3,3' - dione(?), 281¹.
C₁₄H₈N₂O₂ Nitron, α - (3,4 - methylenedioxyphenyl) - *N* - picryl-, 2039^a.
C₁₄H₈O₂ See *Anthraquinone*; *Phenanthrenequinone*.
C₁₄H₈O₂ Diphenic anhydride, 2196¹.
C₁₄H₈O₂Cl₂ Benzoic anhydride, dichloro-, 429^a.
C₁₄H₈O₂ Quinizarin, P 77^a.
C₁₄H₈O₂ Anthraquinone, 2,4,5 - trihydroxy-, 1861¹.
C₁₄H₈O₂S 2 - Anthraquinonesulfonic acid, 3232¹.
C₁₄H₈O₂ Phenanthrenequinone, 2,3,6,7 - tetrahydroxy-, 1560^a.
C₁₄H₈O₂ Compd. from C₂O₂ and MeOH, 40^a.
C₁₄H₈As₂O₂ Arsinic anhydride, *o*, *o'* - dicarboxy-diphenyl-, 480¹.
C₁₄H₈As₂O₂ Arsinic anhydride, *o*, *o'* - dicarboxy-diphenyl-, 480¹.
C₁₄H₈BO₂ Borosalicylic acid, 1386², 2178^a.
C₁₄H₈Br Fluorene, 2 - (bromomethylene)-, 2334^a.
 Phenanthrene, 9-bromo-, 2334^a.
C₁₄H₈BrCl Anthracene, 9,10 - dibromo - 1 (and 2) - chloro - 9,10 - dihydro-, 604^a.
C₁₄H₈BrNO₂ Fluorene, 9 - bromo - 9 - (bromonitromethyl)-, 2334^a.
C₁₄H₈BrNO₂ Benzohydroxamic acid, *p*-bromo-, *p*-bromobenzoate, 673^a.
 3 - Isophenoxaz - 3 - one, ?, ? - dibromo - 9 - hydroxy - 4,8 - dimethyl-, 2649^a.
C₁₄H₈BrN₂ Benzoyl cyanide, 2,4 - dibromophenylhydrazine, 2332¹.
C₁₄H₈Br₂ Fluorene, 9 - bromo - 9 - (dibromomethyl)-, 2334^a.
C₁₄H₈Cl Phenanthrene, 9-chloro-, 2334^a.
C₁₄H₈ClNO 1,5,2 - Pyridopyrimidinone, ? - 4 - phenyl-(?), 1574^a.
 —, 4 - (*p*-chlorophenyl)-(?), 1574^a.
C₁₄H₈O₂ClN₂ 3 - Indazolecarboxylic acid, 2-(*p*-chlorophenyl)-, 2339^a.
 —, 5 - chloro - 2 - phenyl-, 2339^a.
C₁₄H₈ClN₂O₂ 8 - Isophenoxazone, 4 - acetamido-9-chloro-, 2340¹.
C₁₄H₈ClN 5,11 - Fluoravine, 3 - chloro-, 1884^a.
C₁₄H₈ClO Anthrone, 3-chloro-, 2950^a.
C₁₄H₈ClO₂ Benzoic acid, *o* - (*m* - chlorobenzoyl)-, 2335^a.
C₁₄H₈Cl₂NO₂ 9,10 - Anthrol, 1,8(or 4,5) - dichloro-9,10 - dihydro - 10 - nitro-, 60^a.
C₁₄H₈Cl₂N₂O Glyoxylanilide, α,α - dichloro-, 2,4-dichlorophenylhydrazine, 43¹.
C₁₄H₈HgN₂O₂ Benzoic acid, 2,4,6 - trinitro-, *p*-tolylmercuric ester, 465^a, 2483^a.
C₁₄H₈I₂N₂O Pseudoindoxyl, 5 - iodo - 2 - phenylimino-, 506^a.
C₁₄H₈I₂N₂O Pseudoisatin, 5,7 - diiodo, phenylhydrazine, 1422¹.
C₁₄H₈NO₂ Anthraquinone, 2-amino-, 2335^a.
 Fluorene, 9 - nitromethylene-, 2334^a.
C₁₄H₈NO₂ Anthraquinone, aminohydroxy-, 2202^a.
C₁₄H₈NO₂ Anthraquinone, 2 - amino - 4,5 - dihydroxy-, 1861¹.
C₁₄H₈NO₂ Benzaldehyde, 3 - hydroxy - 6 - nitro-, benzoate, 2331^a.
C₁₄H₈N₂ 3 - Indazolenitrile, 2 - phenyl-, 2339^a.
C₁₄H₈N₂O 3 - Indazolenitrile, 2 - phenyl-, 1-oxide, 2339^a.
C₁₄H₈N₂O₂ 1,4 - Imidazopyridine - 2(3) one, 3-nitroso-, Bz deriv., 1863¹.
C₁₄H₈N₂O₂ Pseudoisatin, 6 - nitro - 1 - phenyloxime, 646⁷.
C₁₄H₈N₂O₂ Di - *m* - tolylamine, 2,4,6,2',4',6'-hexanitro-, 475^a.
C₁₄H₈NaO₂ 1 - Benzofuranol, 2 - phenyl-, Na salt, 1276^a.
C₁₄H₈O₂V + 3H₂O, 2174¹.
C₁₄H₈ (See also *Anthracene*; *Phenanthrene*.)
 Tolan, 2300^a, 2651¹.
C₁₄H₈AgNO₂ Carbamic acid, hydroxy-, Ph ester, benzoate, Ag deriv., 3258^a.
C₁₄H₈As₂O₂ Benzoic acid, 2,2' - arsenobis[4-hydroxy-, 479^a.
C₁₄H₈Br₂Br₂O Orcinol, 2,4 - dibromo-, Ba salt, 1200^a.
C₁₄H₈Br₂ClN₂ 3071¹.
C₁₄H₈Br₂ Anthracene, 9,10 - dibromo - 9,10-dihydro-, 2488^a.
C₁₄H₈Br₂O *p* - Cresol, 3,5 - dibromo, benzoate, 1256^a.
C₁₄H₈ClNO Carbamic acid, hydroxy-, chlorophenyl ester, benzoate, 3258^a.
C₁₄H₈ClN₂O₂ *p* - (5 - Methyl - 4 - sulfo - 1-benzothiazolyl)benzenediazonium chloride, 284^a.
C₁₄H₈ClN₂O₂ *m* - Benzotoluide, 5' - chloro-6' - hydroxy - 3,6 - dimitro-, 1562¹.
C₁₄H₈ClN₂O₂ 3 - Isophenoxazone, 4 - amino-5,7 - dichloro - 2,10 - dimethyl-, 2340¹.
C₁₄H₈CrKN₂O₂ 67¹.
C₁₄H₈CrN₂NaO₂ + H₂O, 67¹.
C₁₄H₈HgO₂ Benzoic acid, 4 - benzyloxy - 2-hydroxymercuric, lactone, P 1033^a.
C₁₄H₈NO₂ Stilbene, α - iodo - 2 - nitro-, 2955^a.
C₁₄H₈K₂O₂ α,α' - Stilbenediol, di-K deriv., 278¹.
C₁₄H₈NO₂ Acetophenone, α - diazo - α - phenyl-, 1257¹.
 Indazole, 3-benzoyl-, 508^a.
 Isoindazole, 1-benzoyl-, 509^a.
 —, 1 - formyl - 3 - phenyl-, 509^a.
 2(1) - Naphthyridone, 4 - phenyl-(?), 1573^a.

- 1,5,2 - Pyridopyrimidone, 4 - phenyl-, and salts, 1574².
 Quinoxaline, 2-salicyl-, 2047⁴.
 C₁₄H₁₀N₂O₂ 1,4 - Imidazopyridin - 2 - ol, benzoate, 1275⁷.
 1,4 - Imidazopyridin - 2(3) - one, 3-benzoyl-, 1275⁷.
 3 - Indazolecarboxylic acid, 2 - phenyl-, 2339³.
 7 - Iso - 1,7 - pyrrolopyridin - 3 - ol(?), mono-Bz deriv., 281⁷.
 Phenanthrenequinone, 2,7 - diamino-, 1569⁸.
 Phenazolinol, acetate, 643⁴.
 3 - Pseudindolone, 2 - (N - hydroxyanilino)-, 2824⁶.
 1,7 - Pyrrolopyridin - 3 - ol(?), mono-Bz deriv., 281⁷.
 2,4(1,3) - Quinoxalinedione, phenyl-, 1283¹, 2824¹.
 2(1) - Quinoxalene, 3 - hydroxy - 1 - phenyl-, -HCl, 1284¹.
 C₁₄H₁₀N₂O₂ Benzothiazole, 5 - methyl-1-(p-nitrophenyl)-, 384⁹.
 C₁₄H₁₀N₂O₂ 5(10) - Acridone, methylnitro-, 294¹, 987⁵.
 Anthraquinone, 2 - hydrazino - 3 - hydroxy-, 3270¹.
 C₁₄H₁₀N₂O₂ Benzaldehyde, o - nitro-, oxime, Bz deriv., 510².
 Fluorene, 9 - nitro - 9 - nitromethyl-, 2334⁷.
 Phenanthrenequinone, diaminodihydroxy-, 1569⁸.
 C₁₄H₁₀N₂O₂ Anthranilic acid, N - benzoyl - 4 - nitro-, 646⁷.
 o - Cresol, α - (2,4 - dinitrobenzal)-, 2955⁹.
 Dipicolinic acid, 4 - benzamido-, 70⁶.
 Ictonic acid, 5 - nitro - N - phenyl-, 646⁷.
 C₁₄H₁₀N₂O₆ Benzoic acid, o - (dinitrobenzyl)-, 2950⁹.
 Carbamic acid, hydroxy-, m - nitrophenyl ester, benzoate, 3258⁹.
 o - Cresol, 4,6 - dinitro-, benzoate, 1133².
 C₁₄H₁₀N₂S 1,2,4 - Thiadiazole, 3,5 - diphenyl-, 3087¹.
 C₁₄H₁₀N₂O 9 - Carbazoleacetyl azide, 282⁷.
 C₁₄H₁₀N₂O₂ Benzaldehyde, 2 - cyano - 4 - nitrophenylhydrazone, 819⁴.
 3,3' - Bi[1,4 - imidazopyridin - 2 - ol](?), 1275⁷.
 C₁₄H₁₀N₂O₂ Pseudoisatin, 6 - nitro - 1 - phenyl-, hydrazone, 646⁷.
 C₁₄H₁₀N₂O₂ Benzaldehyde, 2,6 - dinitro-, benzoylhydrazone, 3092².
 C₁₄H₁₀N₂O₈ Nitron, α - o - anisyl - N - picryl-, 2039⁹.
 C₁₄H₁₀N₂O₂ 3,5 - Dinitro - 2 - styrylbenzenediazonium sulfate, 49⁹.
 C₁₄H₁₀O Anthrone, 2950².
 Acetene, diphenyl-, 1226⁴, 1253⁷, 2658⁹.
 C₁₄H₁₀O₂ Benzil, 822⁴, 2938².
 1(2) - Benzofuranone, 2 - phenyl-, 1276⁴, 2044².
 C₁₄H₁₀O₂ Acrylic acid, β - naphthoyl-, 983².
 C₁₄H₁₀O₂ Anthracenesulfonic acid, salts, 2482².
 C₁₄H₁₀O₄ (See also Benzoyl peroxide.)
 Benzil, 2,4 - dihydroxy-, 2946⁴.
 Diphenic acid, 1264⁹.
 C₁₄H₁₀O₂ Benzoic acid, p, p' - dithiobis-, 2195¹.
 C₁₄H₁₀O₂ Benzil, 2,4,6 - trihydroxy-, 2946⁴.
 C₁₄H₁₀O₂ Disulfoxide, 5 - salicylic acid, 476¹.
 C₁₄H₁₀O₂ Salicylic acid, many deriv., salts, 1390¹.
 C₁₄H₁₀O₂ Digallic acid, 1200⁷.
 C₁₄H₁₁AsClN Phenarsazine, 1 - (β - chlorovinyl)-, 1,6-dihydro-, 2250⁶.
 C₁₄H₁₁AsClNO Phenarsazine, 6 - acetyl - 1-chloro - 1,6 - dihydro-, 478⁶.
 C₁₄H₁₁AsCl₂ Arsine, bis(β - chlorovinyl) - 1-naphthyl-, 3250⁷.
 C₁₄H₁₁Br₂NO Toluidine, N - (3,5 - dibromosalicyl)-, 259⁶.
 C₁₄H₁₁Br₂NO₄ Indophenol, ?, ? - dibromo-5,2' - dihydroxy - 2,5' - dimethyl-, 207⁷.
 C₁₄H₁₁Cl Fluorene, 9 - chloro - 9 - methyl-, 2334⁴.
 C₁₄H₁₁ClNO₂ m - Benzotoluide, 5' - chloro - 6' - hydroxy - 2(4 and 4') - iodo-, 1562⁷.
 C₁₄H₁₁ClN₂ Indazole, 2 - [o(4 and p) - chlorobenzyl]-, 3091⁷.
 α - Tolunitrile, α - anilino - m - chloro-, 2333¹.
 C₁₄H₁₁CIN₂O₂ 3 - Isophenoxazone, 4 - amino-9 - chloro - 2,10 - dimethyl-, 2340⁶.
 C₁₄H₁₁CIN₂O₄ m - Benzotoluide, 5' - chloro-6' - hydroxy - 2(3 and 4) - nitro-, 1562⁷.
 C₁₄H₁₁CIN₂O₂ S m - Cresol, 6 - chloro - 2,4-dinitro-, p - toluenesulfonate, 980⁹.
 C₁₄H₁₁ClO₂ Benzophenone, 3' - chloro - 2 - hydroxy - 4 - methyl-, 1257².
 C₁₄H₁₁Cl₂NO₂ m - Benzotoluide, dichloro - 6' - hydroxy-, 1562⁷.
 C₁₄H₁₁CrN₂O₈, 67¹.
 C₁₄H₁₁N Acetonitrile, diphenyl-, 2822².
 Carbazolol, 9-vinyl-, 283³.
 C₁₄H₁₁NO 2,3,γ-Indenopyridone, 1,3-dimethyl-, 495².
 C₁₄H₁₁NO₂ Benzamide, p'-formyl-, 1266⁴, 1420².
 C₁₄H₁₁NO₂ S 2(1) - Benzofuranone, 1 anilino-1-mercapto-, 2048¹.
 C₁₄H₁₁NO₂ 3 - Isophenoxaz - 3 - one, 9 - hydroxy-, 4,8 - dimethyl-, 2619¹.
 Nitron, α - (3,4 - methylenedioxyphenyl)-N phenyl-, 1258⁹.
 C₁₄H₁₁NO₂S₂ Benzothiazolesulfonic acid, 5-methyl-1-phenyl-, 284⁴.
 C₁₄H₁₁NO₄ Benzamide, m - hydroxy-, m - hydroxybenzoate, 1417².
 Carbamic acid, Ph ester, benzoate, 3258⁹.
 Cresol, p - nitrobenzoate, 260⁹.
 —, nitro-, benzoate, 1133².
 Dibenzamide, p, p' - dihydroxy-, 1417².
 C₁₄H₁₁NO₂S₂ 4 - Benzothiazolesulfonic acid, 1 - (p - hydroxyphenyl) - 5 - methyl-, 284⁴.
 C₁₄H₁₁NO₂ Anisic acid, nitrophenyl ester, 260⁹.
 C₁₄H₁₁NO₂ See *Prunasin*.
 C₁₄H₁₁NO₂S₂ Benzothiazolesulfonic acid, 5-methyl - 1 - sulfophenyl-, 284⁴.
 C₁₄H₁₁N₃ Glycinonitrile, N - phenyl - α - phenylimino-, 2823¹.
 1,2,5 - Triazole, 1,3 - diphenyl-, 2954⁷.
 C₁₄H₁₁N₃O Inazole, 3 - benzoyl-, oxime, 508⁷.
 3 - Indazolecarboxamide, 2 - phenyl-, 2339³.
 Phenazine, acetamido-, 644³, 1857¹.
 C₁₄H₁₁N₃O₂ Anthranilonitrile, 6 - nitro - N - m(4 and p)-tolyl-, 819⁷.
 Δ² - 1,2 - Diazene, 4 - (m - nitrophenyl)-1 phenyl-, 2333¹.
 Indazole, 2 - methyl - 4 - nitro-, 3092².
 Isoindazole, 4-nitro-1-tolyl-, 302².
 Phenanthrenequinone, 2,7-diamino-, mono-oxime, 1569⁸.
 α - Tolunitrile, α - anilino - m - nitro-, 2333¹.
 C₁₄H₁₁N₃O₂ o - Toluidine, α - benzal - 4,6 - dinitro-, 491⁴.
 C₁₄H₁₁N₃S Δ² - 1,2,4 - Triazoline, 2,3 - diphenyl-5-thio-, 2053².

- C₁₄H₁₁N₅O₇ α - Tolunitrile, α - amino-, picrate, 963⁹.
- C₁₄H₁₁ (See also *Stilbens*.)
 Anthracene, 9,10-dihydro-, 989⁹.
 Ethylene-, *o*-, diphenyl-, 491⁹, 1401⁹, 2658⁹.
 Isostilbene, 1261⁹.
 Phenanthrene, dihydro-, 2334⁹.
- C₁₄H₁₁AsClO₃ Arsine, (*o* - benzoylphenyl)chloro-
 methyl-, 479⁹.
- C₁₄H₁₁AsNO₃ Phenazarsinic acid, 6-acetyl-,
 479⁹.
- C₁₄H₁₁AsN₂O₃ Benzoic acid, arsenobis[amino-,
and salts, 479⁹.
- C₁₄H₁₁BN₂O₃ Disalicylicboric acid, NH₄ salt,
 2179⁹.
- C₁₄H₁₁BrClO₃, 3071⁹.
- C₁₄H₁₁BrNO₃ *o* - Cresol, α - (4 - bromo - *m*-
 tolylimino)-, 1259⁹.
- C₁₄H₁₁BrN₂O₃ *m*-Benzanide, 4-bromo-, 2338⁹.
- C₁₄H₁₁BrN₂O₃ Benzaldehyde, bromomethoxy-,
 p - nitrophenylhydrazone, 2040⁹.
- C₁₄H₁₁Br₂ Anthracene, dibromo - 1,2,3,4-tetra-
 hydro-, 1272⁹.
- C₁₄H₁₁Br₂N₂S Benzothiazole, 1 - (p - amino-
 phenyl) - 5 - methyl-, perbromide, 2666⁹.
- C₁₄H₁₁ClN Carbazole, 9 - (β - chloroethyl)-,
 283⁹.
- C₁₄H₁₁ClNO₃ *m* - Benzotoluide, 5' - chloro - 6'-
 hydroxy-, 1562⁹.
 3,6 - Dihydroxy - 10 - methylacridinium
 chloride, P 3567⁹.
 Nitrore, α - p - anisyl - *N* - (p - chloro-
 phenyl)-, 2591⁹.
- C₁₄H₁₁ClN₂O Glyoxylanilide, α - chloro-, phenyl-
 hydrazone, 437⁹.
- C₁₄H₁₁ClN₂ Acetophenone, 2,4 - dichlorophenyl-
 hydrazone, 2047⁹.
- C₁₄H₁₁INS Benzothiazole, 1 - phenyl-, meth-
 iodide, 2339⁹.
- C₁₄H₁₁IN₂O₃ Benzaldehyde, nitro-, 4 - iodo - *o*-
 tolylhydrazone, 3259⁹.
- C₁₄H₁₁N₂ α - Tolunitrile, α - anilino-, 503⁹.
- C₁₄H₁₁N₂O Anthranilic acid, *N* - (*o* - amino-
 phenyl) - *N* - methyl-, cyclic amide,
 967⁹.
 9 - Carbazoleacetamide, 282⁹.
 Urea, γ - (p , p' - methylenediphenyl)-, 3267⁹.
- C₁₄H₁₁N₂OS 3 - Isophenothiazone, 9 - dimethyl-
 amino-, 513⁹.
- C₁₄H₁₁N₂O₂ Benzaldehyde, oxime, \circ peroxide,
 49⁹.
 Benzamide, *N* - (*o* - formylphenyl)-, oxime,
 509⁹.
- C₁₄H₁₁N₂O₃ Benzophenone, p - nitro-, methyl-
 oxime, 490⁹.
 Nitrore, α - (nitrophenyl) - *N* - p - tolyl-,
 1258⁹.
- C₁₄H₁₁N₂O₃ Anthranilic acid, *N* - methyl - *N* -
 (*o* - nitrophenyl)-, 987⁹.
- C₁₄H₁₁N₂S Benzothiazole, 1 - (p - aminophenyl)-
 5-methyl-, 284⁹, 2052⁹, 2656⁹; *and*
chloroplatinate, 1411⁹, 1412⁹.
- C₁₄H₁₁N₂O 1,2,3 - Benzotriazole, 7 - acetamido-
 1-phenyl-, 282⁹.
- Phenazine, acetamidamino-, *and perchlorate*,
 644⁹.
- C₁₄H₁₁N₂O₂ 2,1,3 - Benzotriazole, 2 - (5 - acet-
 amidosalicyl)-, 514⁹.
 Glyoxylanilide, p - phenylazo-, oxime, 2646⁹.
- C₁₄H₁₁N₂O₃ Acetophenone, α - (p - nitrophenyl-
 amino)-, 362⁹.
- Phthalaldehyde, oxime - nitrophenylhydra-
 zone, 2637⁹.
- C₁₄H₁₁N₂O₄ Acetanilide, 4 - hydroxy - 3 - (*o*-
 nitrophenylazo)-, 514⁹.
 Benzaldehyde, 2,4 - dinitro-, tolylhydra-
 zone, 3092⁹.
- C₁₄H₁₁N₂O₃ Acetanilide, 4 - anilino - 3,5 - di-
 nitro-, 2823⁹.
 Benzaldehyde, 3 - methoxy - 4 - nitro-, p -
 nitrophenylhydrazone, 2040⁹.
- C₁₄H₁₁N₂O₃ Acetophenone, α - amino-, picrate,
 263⁹.
 1 - Propanone, 1 - (2 - pyridyl)-, picrate,
 1281⁹.
- C₁₄H₁₁O Dibenzohomopyran, 1423⁹.
 α - Toluinaldehyde, α - phenyl-, 636⁹.
- C₁₄H₁₁O₂ Anthraquinone, 1,2,3,4 - tetrahydro-,
 1272⁹.
 Benzoic acid, benzyl ester, 128⁹, 130⁹,
 1599⁹, 2898⁹, 3042⁹.
- C₁₄H₁₁O₂ p , p' - Bitolyl, 3,3' - sulfonyl-(?),
 1857⁹.
- C₁₄H₁₁O₂ Acrylophenone, β - 2 - furyl - p - meth-
 oxy-, 823⁹.
 Benzoic acid, 650⁹, 1639⁹.
 2,4 - Cresotic acid, Ph ester, 51⁹.
 2 - Furanacrylic acid, benzyl ester, 653⁹.
 o - Toluic acid, η - (p - hydroxyphenyl)-,
 2486⁹, 2710⁹.
- C₁₄H₁₁O₃ Malonic acid, (*o* - phenyl - $\Delta^{1,4}$ - p -
 tadienyldiene)-, 2040⁹.
- C₁₄H₁₁O₃ Acid, *m*. 171-2⁹, from ethyl α , β -
 dibromocinnamate and the mono-Na de-
 riv. of di-Et malonate, 2643⁹.
- C₁₄H₁₁AsO Phenoxarsine, 6-ethyl-, 2039⁹.
- C₁₄H₁₁AsO₃ 6 - Ethylphenoxarsonium oxide,
 2038⁹.
- C₁₄H₁₁AsO₃ Arsinic acid, (*o* - benzoylphenyl)-
 methyl-, 479⁹.
 o - Carboxyphenylmethylphenylarsonium ox-
 ide, 2038⁹.
- C₁₄H₁₁AsO₃ 6 - Ethylsulfophenoxarsonium ox-
 ide, 2038⁹.
- C₁₄H₁₁BrN₂ Benzaldehyde, (p - bromophenyl)-
 methylhydrazone, 45⁹.
- C₁₄H₁₁BrN₂S Carbanilide, 4 - propio - 3 - methyl-
 thio-, 1259⁹.
 Urea, α - (p - bromophenyl) - thio - p - (p -
 tolyl)-, 2481⁹.
- C₁₄H₁₁BrO₂ 2 - Naphthol, 6 - bromo - 1 - ethyl-,
 acetate, 59⁹.
- C₁₄H₁₁Br₂O₂ 2,4 - Pentamedione, 3 - (α , β , γ -
 tribromo - γ - phenylpropylidene)-(?),
 2941⁹.
- C₁₄H₁₁ClN₂O Phenol, p - (4 - chloro - 2,5 - xylyl-
 azo)-, 255⁹.
- C₁₄H₁₁ClN₂O₂ Resorcinol, 4 - (4 - chloro - 2,5 -
 xylylazo)-, 255⁹.
- C₁₄H₁₁ClN₂O₃ Inophenol - 1 - thiosulfonic
 acid, 3' - chloro - 3 - dimethylamino-,
and Na salt, 513⁹.
- C₁₄H₁₁ClO Anisole, o - (ϕ - chlorobenzyl)-, 286⁹.
- C₁₄H₁₁Cl₂N Benzohydrazilamine, *N*, *N* - dichloro-
 α -methyl-, 2180⁹.
 Dichloramine-M, 1456⁹.
- C₁₄H₁₁OF₂N₂O₃, 671⁹.
- C₁₄H₁₁OF₂N₂O₃ α -Pyrrrole, bis(hydroxymercuri)-
 1 - phenyl-, diacetate, 2203⁹.
- C₁₄H₁₁IN₂ Benzaldehyde, 4 - iodo - o - tolyl-
 hydrazone, 3259⁹.
- C₁₄H₁₁IN₂O Carbanilide, 4 - iodo - 2 - methyl-,
 2180⁹.
- C₁₄H₁₁N 3 - Anthranine, 9,10 - dihydro-, 1271⁹.
 Benzalazine, α - benzyl-, 823⁹.
 —, α -ethyl-, 2817⁹.
 Benzylamine, *N* - benzal-, 2648⁹.

- Carbazole, 9-ethyl-, 987¹.
2,3,γ - Indenopyridine, 1,3 - dimethyl-, 495¹.
C₁₄H₁₁NO Acenaphthene, acetamido-, 651¹.
Desoxybenzoin, oxime, 982¹.
Nitroson, α - phenyl - N - p - tolyl-, 1258¹.
C₁₄H₁₁NO₃ Carbanilic acid, thiol-, benzyl and p-tolyl esters, 1563¹.
C₁₄H₁₁NO₃ Acetamide, 2 - hydroxy - 5 - phenyl-, 1858¹.
Benzoic acid, m (and p) - amino-, benzyl ester, 2650¹.
Benzotoluide, hydroxy-, 1417².
Cycloiminetoluquinone, o - tolyl-, 2649².
Mandelanilide, 264¹.
Nitroson, α - salicyl - N - p - tolyl-, 1258¹.
C₁₄H₁₁NO₃ Guaiacol, carbanilate, 3086¹.
Nitroson, α - (4 - hydroxy - m - anisyl) - N - phenyl-, 1258¹.
Phenetole, o - nitro - β - phenyl-, 1423¹.
C₁₄H₁₁NO₃ Aconitic acid, anil, Et ester, 3256¹.
Indophenol, 5,2' - dihydroxy - 2,5' - dimethyl-, 2649¹.
C₁₄H₁₁NO₃ Nicotinic acid, 5 - acetyl - 4 - furyl-1,6 - dihydro - 6 - keto - 1,2 - dimethyl-, 2497¹.
C₁₄H₁₁NO₃ o - Cresol, nitro-, p - toluenesulfonate, 1133¹.
C₁₄H₁₁N₂O 9 - Carbazoleacetic acid, hydrazide, and -HCl, 282¹.
α - Toluamide, N - phenylimino-, oxime, 3261¹.
C₁₄H₁₁N₂O₃ Semicarbazide, 1 - benzoyl - 1-phenylthio-, 2053¹.
C₁₄H₁₁N₂O₃ 1,2,3 - Benzotriazole - 4,7 - dione, 3,7i - dihydro - 5 - methyl - 1 - o - tolyl-, 2649¹.
Biuret, 1,5 - diphenyl-, 973¹.
Quinone, 4 - p - tolylsemicarbazone, 478¹.
Tolualdehyde, p - nitrophenylhydrazone, 3261¹.
C₁₄H₁₁N₂O₃ Anthranil, 3,4,5,6 - tetrahydro-2 - p - nitrobenzylamino-, 1262¹.
C₁₄H₁₁N₂O₃ Anisaldehyde, 2 - hydroxy - 5-nitro-, phenylhydrazone, 1701¹.
Dibenzylamine, dinitro-, and salts, 3261¹.
Ditolylamine, dinitro-, 475¹.
C₁₄H₁₁ Anthracene, 1,2,3,4 - tetrahydro-, 1271¹, 1272¹.
Bibenzyl, 977¹, 2300¹.
Phenanthrene, tetrahydro-, 1274¹, 2334¹.
C₁₄H₁₁As₂ Arsenic, diphenyltetramethyl-, methiodide, 1132¹.
C₁₄H₁₁Br₂O₂ 2,4 - Pentanedione, 3 - (β,γ - dibromo - γ - phenylpropylidene)-, 2941¹.
C₁₄H₁₁ClN₂ + H₂O See *Acriflavine*.
C₁₄H₁₁ClO₂PS Thiophosphoryl monochloride, di-p-tolyl ester, 2325¹.
C₁₄H₁₁CuN₂O₂ + H₂O, 2173¹.
C₁₄H₁₁IN Stillbazole, methiodide, 2498¹.
C₁₄H₁₁N₂ Acridan, 4-amino-1-methyl-, 294¹.
Hydrazine, (9,10 - dihydro - 2 - anthryl)-, -HCl, 1272¹.
Quinoline, α-methylanilino-, 2568¹.
C₁₄H₁₁N₂O Acetanilide, α-anilino-, 3083¹.
Formamidine, N - hydroxy - N (and N') phenyl - N' (and N) - p - tolyl-, and -HCl, 973¹.
Hemipyrocyanin, Me ether, and chloroaurate, 1864¹.
Propionaldehyde, α - 2 - fural-, phenylhydra-
- Toluene, o, o' - azoxybis-, 2927¹.
C₁₄H₁₁N₂O₂ Anthranilic acid, N - (o - arginophenyl) - N - methyl-, 987¹.
Benzaldehyde, o - (α - hydroxybenzylamino)-, oxime, 510¹.
Benzylamine, o - nitro - N - tolyl-, 4821¹.
2,7 - Naphthylenediamine, N, N' - diacetyl-, 4981¹.
C₁₄H₁₁N₂O₃ p - Toluene sulfonic acid, benzalhydrazide, 260¹.
C₁₄H₁₁N₂O₃ Cinchoninic acid, 3 - acetamido - 2-methyl-, Me ester, 2955¹.
C₁₄H₁₁N₂O₃ 3,4 - Pyrroledicarboxylic acid, 1-(p - aminophenyl)-, 2,5 - dimethyl-, -HCl, 278¹.
C₁₄H₁₁N₂O₃ Benzenesulfonanilide, N - ethyl-m-nitro-, 642¹.
C₁₄H₁₁N₂O₃ Indophenol - 1 - thiosulfonic acid, 3 - dimethylamino-, and Na salt, 513¹.
C₁₄H₁₁N₂O₃ Glycine, N - (N - phthalylglycyl)-Et ester, 2052¹.
1 - Hydantoinacetic acid, 5 - anisal - 3 - methyl-, and Na salt, 636¹.
C₁₄H₁₁N₂O₃ Glyoxylohydroxamic acid, oxime, tri-Ac deriv., 2638¹.
C₁₄H₁₁N₂S Carbanilide, p - methylthio-, chloroplatinate, 1411¹.
C₁₄H₁₁N₂ 2,1,3 - Benzotriazole, 2 - (p - dimethylaminophenyl)-, and -HCl, 514¹.
C₁₄H₁₁N₂O Benzaldehyde, δ - anilinosemicarbazone, 324¹.
2,1,3 - Benzotriazole, 2 - (p - dimethylaminophenyl)-, 1-oxide, and -HCl, 514¹.
Glyoxylanilide, α - amino-, phenylhydrazone, and -HCl, 43¹.
C₁₄H₁₁N₂O Aniline, N, N - dimethyl - p - (o - nitrophenylazo)-, and -HCl, 514¹.
C₁₄H₁₁N₂O₃ Uric acid, 1,3,7 - trimethyl - 9-phenyl-, 2810¹.
C₁₄H₁₁N₂O Aniline, N - ethyl-, picrate, 510¹.
C₁₄H₁₁N₂O₃ Benzyl alcohol, α - methylamino-, picrate, 1134¹.
1 - Propanol, 1 - (2 - pyridyl)-, picrate, 1281¹.
C₁₄H₁₁N₂O₃ See *Benzophos*.
C₁₄H₁₁O Benzohydrol, α-methyl-, 645¹.
Benzyl ether, 2194¹.
p-Cresol, 2-benzyl-, 2038¹.
C₁₄H₁₁O Benzyl peroxide, 2988¹.
Ethane, s-diphenoxy-, 2194¹.
Hydrobengoin, 971¹, 986¹.
2 - Naphthoic acid, 1 - methyl-, Et ester, 1269¹.
2 - Naphthol, 1 - ethyl-, acetate, 50¹.
Phenol, o - p - phenylethoxy-, 1423¹.
C₁₄H₁₁O₂ Benzyl alcohol, α, α'-dithiobis-, 238¹.
C₁₄H₁₁O₃ 1 - Acenaphthenesulfonic acid, Et ester, 274¹.
Anisole, p - (p - tolylsulfonyl)-, 2483¹.
p - Toluene sulfonic acid, benzyl ester, 977¹; o - tolyl ester, 2483¹.
C₁₄H₁₁O₂ 1,2 - Benzopyran - 4 - acetic acid, 2-keto - 7 - methyl-, Et ester, 824¹.
2 - Naphthaleneacetic acid, 1,2,3,4 - tetrahydro - α,1 - diketone, Et ester, 260¹.
1,2 - Naphthalenedicarboxylic acid, 3,4-dihydro-, di-Me and mono-Me esters, 1269¹.
C₁₄H₁₁O₂S Disulfide, bis (m-methylsulfonylphenyl)-, 2647¹.
C₁₄H₁₁O Benzene, 1,9 - bis (formylacetyl)-, 2,4-dimethoxy-, 517¹.
C₁₄H₁₁O₂S Acenaphthenedisulfonic acid, di-Me ester, 2751¹.

- C₁₁H₁₄O₆S₄: Disulfoxide, bis (*m* - methylsulfonyl-phenyl), 2647⁸.
- C₁₁H₁₄O₇: Fisetol, triacetate, 2601¹.
- C₁₁H₁₄O₈: Pentasulfide, dibenzyl, 464³.
- C₁₁H₁₄AsN₂O₄: Arsanilic acid, *N* - (aminobenzo-*o*l)-3 - methyl-, 1562¹.
- C₁₁H₁₄BrNO₂: 2 - Naphthol, 7 - acetamido - 1,3 - dibromo - 5,6,7,8 - tetrahydro-, acetate, 497¹.
- C₁₁H₁₄ClN₂: Ethylenediamine, *N* - (*o* - chlorophenyl) - *N'* - phenyl-, and -HCl, 283¹.
- C₁₁H₁₄ClN₂O₂: Oxazolidine, 5 - chloromethyl-2-imino-, picrolonate, 2052³.
- C₁₁H₁₄N: Benzylamine, *N* - methyl - *N* - phenyl-, 2646¹.
- Carbazole, 1,2,3,4 - tetrahydro - 9 - vinyl-, 283¹.
- Diphenylamine, *N* - ethyl-, -HCl, 515².
- Ethylamine, β , β -diphenyl-, and chloroaurate, 2822².
- C₁₁H₁₄NO₅ (10) - Acridone, 1,2,3,4 - tetrahydro-methyl-, 521⁴.
- Aniline, *o* - β - phenylethoxy-, 1423⁴.
- Benzohydrol, α - (aminomethyl)-, 635⁴.
- Cyclohexanenitrile, 1 - benzyl - 2 - keto-, 1262².
- Morpholine, 4 - naphthyl-, 631⁴.
- C₁₁H₁₄NO₂S: *p* - Toluenesulfonamide, *N* - ethyl-, 3260².
- C₁₁H₁₄NO₂: 3 - Indolebutyric acid, γ - keto-, Et ester, 279².
- 3 - Quinaldinebutyric acid, 4 - hydroxy-, 3263².
- C₁₁H₁₄NO₂S: 2^o - Butanesulfonic acid, 4 - (2-naphthylimino)-, 2328².
- C₁₁H₁₄NO₄: 2,6 - Indolecarboxylic acid, di Et ester, 506¹.
- C₁₁H₁₄NO₃: 3 - Pyrrolidineacetic acid, 3 - hydroxy-2,5 - diketo - 1 - phenyl-, Et ester, 3256¹.
- 4,3 - Pyrrolopyrrole, 2,6 - dicarboxylic acid, α - keto - 5,8 - dimethyl-, Et Me ester, 2663¹.
- C₁₁H₁₄NO: Pyruvic acid, (4 - carboxy - 2-nitrophenyl)-, Et ester, 506¹.
- C₁₁H₁₄N₂: Di - *p* - toluenesulfenamide, 1855².
- C₁₁H₁₄N₂: Acetophenone, α - amino, phenyl-hydrazone, 263¹.
- Aniline, *N*, *N* - dimethyl - *p* - phenylazo-, ferricyanide, 978¹.
- Dimethyl yellow, 1828².
- C₁₁H₁₄N₂O: 2,6 - Lutidine, 3 - (*p* - methoxy-phenylazo)-, and -HCl, 2955¹.
- C₁₁H₁₄N₂O: 2 - Indolecarboxamide, 6 - cyano-*N* - (β , β - dimethoxyethyl)-, 506¹.
- C₁₁H₁₄N₂O₂S: Benzenesulfonic acid, *p* - (β - dimethylaminophenylazo)-, sodium salt--see Methyl orange.
- C₁₁H₁₄N₂O: 2 - Naphthol, 7 - acetamido-5,6,7,8-tetrahydrodithio-, acetate, 497¹.
- C₁₁H₁₄N₂O₁₁: Hydrazine, (β - aminobutyl)-, dipicrate, 3250¹.
- C₁₁H₁₄AsI: Dimethyldiphenylarsonium triiodide, 1403¹.
- C₁₁H₁₄AsN₂O₂S: Methanesulfonic acid, arseno-laslanilino, and *Na* salts, 2815¹.
- C₁₁H₁₄BrNO₂: Valeric acid, δ - bromo - γ - hydroxy -, lactone, 3084¹.
- C₁₁H₁₄ClN: Carbazole, 9 - (β - chloroethyl)-1,2,3,4 - tetrahydro-, 2833¹.
- C₁₁H₁₄CuN₂O₂: 2672².
- C₁₁H₁₄N: Acridine, tetrahydro-, methiodide, 521⁴.
- C₁₁H₁₄N₂: Polidine, P 1710⁷.
- Toluene, *o*,*o'* - hydrazobis-, ferricyanide, 978¹.
- C₁₁H₁₄N₂O: Pyrrole, 1 - (*p* - acetamidophenyl)-2,5-dimethyl-, 278².
- C₁₁H₁₄N₂O₄: 4,4' - Bi - *o* - anisidine, ferrocyanide, 978¹.
- C₁₁H₁₄N₂O₃: Barbituric acid, 5 - ethyl - 5 - phenethyl-, 471⁹.
- C₁₁H₁₄N₂O₃: 3 - Pyrroleacrylic acid, 5 - carbethoxy- α - cyano - 2 - ethyl - 4 - methyl-, 1429³.
- C₁₁H₁₄N₂O₂S: 2,5 - Isopyridindole, 2 - methyl-, methyl sulfate salt, 507⁴.
- C₁₁H₁₄N₂O₂S₂: *p*,*p'* - Bitolyl - 3,3' - disulfonamide, 1857².
- C₁₁H₁₄N₂O: 2 - Naphthol, 7 - acetamido - 5,6,7,8-tetrahydronitro-, acetate, 497¹.
- C₁₁H₁₄N₂S: *p* - Toluidine, 2,2' - dithiobis-, 284⁴.
- C₁₁H₁₄N₂S₂Zn: *m* - Toly mercaptan, 6 - amino-, Zn deriv., 284⁴.
- C₁₁H₁₄N: Aniline, *p* - (*o* - aminophenylazo)-*N*, *N* - dimethyl-, 514⁴.
- o* - Toluidine, 5,5'-azobis-, 256².
- C₁₁H₁₄N₂O₂S: Suberic acid, α - keto-, 2,4 - dinitro-phenylhydrazones, 1560¹.
- C₁₁H₁₄N₂O: Indazole, 3 - amino - 4,5,6,7 - tetrahydro - 7 - methyl-, picrate, 1263².
- C₁₁H₁₄O: Acetophenone, α , α - diallyl-, 133¹.
- 1(2) - Anthracenone, hexahydro-, 1272¹.
- Cyclohexanone, 2 - benzal - 6 - methyl-, 2931¹.
- Phenanthrone hexahydro-, 1272¹, 1274¹.
- C₁₁H₁₄O₂: 1 - Naphthaleneacetic acid, 3,4 - dihydro-, Et ester, 2201².
- Δ^1 , Δ^2 (?) - Naphthaleneacetic acid, 3,4 - dihydro-, Et ester, 2201².
- 2 - Naphthoic acid, 3,4 - dihydro - 1 - methyl-, Et ester, 1260².
- C₁₁H₁₄O₂: 2 - Naphthalenebutyric acid, 5,6,7,8-tetrahydro γ keto- 1272¹ and *A* salt, 1274¹.
- C₁₁H₁₄O₂: Δ^1 - 3 - Hexenol, acid phthalate, 2331¹.
- C₁₁H₁₄O: Oxalacetic acid, phenyl, di Et ester, 2478¹.
- C₁₁H₁₄O₂S: 2 Thionaphthegol, glucoside, 2951¹.
- C₁₁H₁₄O₂: Succinic acid, 4 - carbethoxy - *m*-anisyl-, 1701².
- C₁₁H₁₄ClO₂S: 9 - Anthracenesulfonyl chloride, 1,2,3,4,5,6,7,8 - octahydro-, 1274¹.
- 9 - Phenanthrenesulfonyl chloride, 1,2,3,4,5,6,7,8 - octahydro-, 1274¹.
- C₁₁H₁₄IN₂: 2 - Allyl - 1 - benzyl - 3-methyl 2-pyrazolium iodide, 2053².
- C₁₁H₁₄NO: 9 - Carbazoleethanol, 1,2,3,4 - tetrahydro-, 283¹.
- Phenanthrone, hexahydro-, oxime, 1274¹.
- C₁₁H₁₄NO₂: 5 - Acridinecarboxylic acid, octahydro-, 522⁴.
- Anthranilic acid, *N* - (3 - methylcycloheptylidene)-, 521⁴.
- 1,3(2,4) - Isoquinolinedione, 4 - ethyl - 4-propyl-, 375².
- Oxindole, 5 - ethoxy - 1,3 - dimethyl - 3-vinyl-, 1140².
- C₁₁H₁₄NO₂: Valeric acid, γ - hydroxy - α - [(*N*-methylbenzamido)methyl]-, lactone, 3084¹.
- C₁₁H₁₄NO₂S: Malonanilic acid, α - acetyl - *m*-methyl - β - thio-, Et ester, 471⁹.
- Xylidine, benzenesulfonate, 651².
- C₁₁H₁₄NO₂: Valeric acid, δ - (*o* - acetamidobenzo-*o*yl)-, 3263².
- C₁₁H₁₄NO₂S: Malonanilic acid, α - acetyl - β -methoxy - β - thio-, Et ester, 471⁹.
- p* - Phenetidine, benzenesulfonate, 651².
- C₁₁H₁₄NO₂: Malic acid, α - [(phenylcarbonyl)-

- methyl]-, mono-Et ester, and *K* salts, 3256².
- $C_{14}H_{17}NO_2$ Indican, 125¹.
- 2 - Pyrroleacrylic acid, α , 4 - dicarboxy - 3, 5 - dimethyl-, Me Et ester, 2663³.
- $C_{14}H_{17}NS$ Camphothiazole, 2-methyl-, 1706⁴.
- $C_{14}H_{17}N_2O$ Cyclohexerone, methyl-, phenylsemicarbazone, 3485¹.
- Pyrazole, 1 - carbamyl - 3, 5 - dimethyl- 4 - phenethyl-, 1269².
- $C_{14}H_{17}N_2$ Compd., m. 254°, from dimethylpyrrole and N_2H_4 , 2822².
- $C_{14}H_{18}$ Anthracene, octahydro-, 1270³, 2300³.
- Phenanthrene, 1, 2, 3, 4, 5, 6, 7, 8 - octahydro-, 1270³, 1274².
- $C_{14}H_{18}Br_2N_2O_2$ Bisuracil, dibromohexamethyl-, 1249⁴.
- $C_{14}H_{18}N_2O_2$ Naphthylenediamine, *N*, *N'* - diacetyl - 1, 2, 3, 4 - tetrahydro-, 498².
- $C_{14}H_{18}N_2O_2$ Malonic acid, acetonyl-ethyl-, phenylhydrazon, 3480².
- $C_{14}H_{18}N_2O_2$ Malonic acid, phenylcarbamido-, diethyl ester, 2811¹.
- Succinamic acid, β - hydroxy - β - [(phenylcarbamyl)methyl]-, Et ester, 3256¹.
- $C_{14}H_{18}N_2O_2$ Carbamic acid, ethylhydroxy-, Bu ester, *m* (and *p*) - nitrobenzoate, 970¹.
- $C_{14}H_{18}N_4$ 3, 3' - Biindazole, 4, 5, 6, 7, 4', 5', 6', 7' - octahydro-, 1262².
- $C_{14}H_{18}O$ 1 - Anthrol, 1, 2, 3, 4, 5, 6, 7, 8 - octahydro-, 1272².
- γ - Pentenophenone, α - ethyl - α - methyl, 1 - Phenanthrol, 1, 2, 3, 4, 5, 6, 7, 8 - octahydro-, 1274².
- $C_{14}H_{18}O_2$ 1 - Naphthaleneacetic acid, 1, 2, 3, 4 tetrahydro-, Et ester, 2202¹.
- Naphthalenebutyric acid, 5, 6, 7, 8 - tetrahydro-, 1272¹.
- $C_{14}H_{18}O_2S$ 9 - Anthracenesulfonic acid, 1, 2, 3, 4, 5, 6, 7, 8 - octahydro-, *Na* salt, 1273³.
- $C_{14}H_{18}O_2$ Acetoacetic acid, α - phenethyl-, Et ester, 1269².
- Δ^1 - 3 - Heptenone, 1 - (4 - hydroxy - *m*-anisyl)-, 2944¹.
- Δ^1 - 3 - Hexenone, 1 - (4 - hydroxy - *m*-anisyl)- 5 - methyl-, 2944¹.
- 1 - Naphthaleneacetic acid, 1, 2, 3, 4 - tetrahydro - 1 - hydroxy-, Et ester, 2201¹.
- $C_{14}H_{18}O_2S$ 9 - Anthracenesulfonic acid, 1, 2, 3, 4, 5, 6, 7, 8 - octahydro-, and salts, 1273³.
- 9 - Phenanthrenesulfonic acid, 1, 2, 3, 4, 5, 6, 7, 8 - octahydro-, and salts, 1274².
- $C_{14}H_{18}O_4$ 7 - Butenophenone, 3, 4, 5 - trimethoxy-, 466².
- Phthalic acid, Bu Et ester, P 3491¹.
- $C_{14}H_{18}O_5$ Glutaric acid, β - keto - α , α , γ , γ - tetramethyl-, cyclic anhydride with dimethylmalonic acid, 2188².
- Pseudophloroglucinoldicarboxylic acid, *C* - dimethyl-, di-Et ester, 649².
- $C_{14}H_{18}O_{11}$ Mucic acid, tetraacetate, 817².
- $C_{14}H_{18}BrN_2O_2$ Malonamide, α - bromo - *N* - isobutyl - *N'* - *p* - tolyl-, 1697¹.
- $C_{14}H_{18}BrO_4$ *d* - Glucose, tetraacetyl bromo-, 2034¹.
- $C_{14}H_{18}ClN_2O$ Crotonanilide, β - butylamino - α -chloro-, 43².
- $C_{14}H_{18}ClO_4$ *d*-Glucose, tetraacetylchloro-, 2034¹.
- $C_{14}H_{18}IO_4$ *d*-Glucose, tetraacetyliodo-, 2034¹.
- $C_{14}H_{18}N$ Acridine, octahydro - 10 - methyl-, 3221¹.
- Propene, 2, 2' - (dimethylamino - *p* - phenyl-enebis)-, 497¹.
- $C_{14}H_{18}NO$ Benzamide, *N* - (cyclohexylmethyl)-, 825¹.
- Hydrotheserolene, and *HCl*, 1427².
- α - Penteno - *p* - toluide, β - methyl-, 1695².
- $C_{14}H_{18}NO_2$ Oxindole, 5 - ethoxy - 3 - ethyl- 1, 3 - dimethyl-, 1140².
- $C_{14}H_{18}NO_2S$ 9 - Anthracenesulfonamide, 2, 2, 3, 4, 5, 6, 7, 8 - octahydro-, 1273³.
- 9 - Phenanthrenesulfonamide, 1, 2, 3, 4, 5, 6, 7, 8 - octahydro-, 1274².
- $C_{14}H_{18}NO_4$ Carbamic acid, ethylhydroxy-, Bu ester, benzoate, 969².
- Carbanilic acid, *p* - carboxy, Bu Et ester, 979².
- Dnicotinic acid, 1, 2 - dihydro - 1, 6 - dimethyl - 2 - methylene-, di-Et ester, perchlorate, 2497¹.
- Nicotinic acid, 5 - acetyl - 1, 6 - dihydro - 1 - isobutyl - 6 - keto - 1, 2 - dimethyl-, 2497¹.
- Oximidocarbonic acid, Bu Et ester, Bz deriv., 970².
- 2 - Pyrroleacrylic acid, 4 - carboxy - 3, 5 - dimethyl-, di-Et ester, 2663³.
- Terephthalic acid, diethylamino-, di-Me ester, 490².
- $C_{14}H_{18}NO_2$ Serine, β - (*p*-carboethoxyoxyphenyl)-, Et ester, 76².
- $C_{14}H_{18}NO_2$ Succinic acid, aniline salt, 2034¹.
- $C_{14}H_{18}NO_2$ Malic acid, aniline salt, 2034¹.
- $C_{14}H_{18}N_2$ Compd. from 2, 4 - dimethylpyrrole and H_2CN and NH_3 , m. 174°, 2336².
- $C_{14}H_{18}$ Anthracene, decahydro-, 1273¹.
- $C_{14}H_{18}AsNO_2$ Carbanilic acid, 5 - arsono - 2 - (carboxyoxo), diisopropyl and di-Pr esters, 979².
- $C_{14}H_{18}IN$ Acridine, octahydro-, methiodide, 522¹.
- $C_{14}H_{18}INO_2$ 1, 2, 3, 4 - Tetrahydro - 2, β - hydroxyethyl - 2 - methylisoquinolinium iodide, acetate, 825¹.
- $C_{14}H_{18}NO_{11}$ Tartaric acid, aniline salt, 2034¹.
- $C_{14}H_{18}NO_2$ Crotonanilide, β -butylamino-, 43².
- Pipecoline, α - amino - 1 - methyl-, Bz deriv., 659².
- $C_{14}H_{20}N_2O_2$ Hydrazine, α , β - diisobutyl - α -phenyl-, 1254¹.
- Malonamide, *N* - isobutyl - *N'* - *p* - tolyl-, 1697¹.
- Pseudogenescrolimethine, 1700².
- $C_{14}H_{20}N_2O_2S$ Δ^1 - Pyrazoline, 5 - isobutyl - 3 - methyl - 1 - (phenylsulfonyl)-, 2666².
- $C_{14}H_{20}N_2O_4$ *p* - Toluic acid, 3 - nitro-, diethylaminoethyl ester, 1700².
- $C_{14}H_{20}N_2O_4$ *p* - Methylphenylammonium tungstate, 2191².
- $C_{14}H_{20}N_2O_4$ Bisuracil, hexamethyl-, 1249⁴.
- $C_{14}H_{20}N_2O_7$ Cyclohexylamine, 2 - ethyl-, picrate, 1862².
- $C_{14}H_{20}O$ Acetophenone, 2, 5 - dipropyl-, 1406¹.
- $C_{14}H_{20}O_2$ Caprophenone, α - methoxy-, 2671¹.
- 3 - Hexanol, 1 - phenyl-, acetate, 2331¹.
- Propionic acid, α - ethyl - γ - phenylpropyl ester, 2331¹.
- $C_{14}H_{20}O_2$ 2, 5 - Heptanediol, 2 - benzoate, 2931¹.
- 3 - Heptanone, 1 - (4 - hydroxy - *m* - anisyl)-, 2944¹.
- 3 - Hexanone, 1 - (3, 4 - dimethoxyphenyl)-, 2944¹.
- 1 - (3 - hydroxy - *m* - anisyl) - 5 - methyl-, 2944¹.

- 3 - Pentanone, 1 - (4 - hydroxy - *m* - anisyl)-4,4-dimethyl-, 2944¹.
- C₁₄H₂₀O₄ Valeraldehyde, γ , γ -hydroxy-, benzoate of di-Me acetal, 2931⁴.
- C₁₄H₂₀O₄ Eganthic acid, α - acetyl - α - allyl- γ - hydroxy - β , δ - diketo-, Et ester, 466⁷.
- C₁₄H₂₀O₇ 2,3,4 - Furantricarboxylic acid, 2,3,4-dihydro - 5 - methyl-, tri-Et ester, 246⁷.
- C₁₄H₁₄O₆ Ethylenetetracarboxylic acid, tetra-Et ester, *SnCl₄* addn. compds., 3251¹.
- C₁₄H₂₀O₃ Glucoside, α - methyl-, *p* - toluenesulfonate, 250⁴.
- C₁₄H₂₀O₁₀ Arabonic acid, Me ester, tetraacetate, 817⁹.
- C₁₄H₂₇AsN₃O₇ *o* - Benzenedicarbamic acid, 4-arsono-, diisopropyl and di-Pr esters, 979².
- C₁₄H₂₁IN Allyldiethylphenylammonium iodide, *CHI₃* addn. compd., 1403¹.
- C₁₄H₂₅N Benzylamine, *N* - cyclohexyl - α - methyl-, and -HBr, 2828².
- Phenethylamine, *N* - cyclohexyl-, and -HBr, 2828².
- Epilidone, 1 - (α - ethylbenzyl)-, 288²; and -HCl, 519⁴.
- C₁₄H₂₁NO Acetophenone, 2,5 - dipropyl-, oxime, 1406¹.
- Piperidine, 1 - (γ - phenoxypropyl)-, salts, 1424⁷.
- C₁₄H₂₁NO₂ Benzamide, *N* - (α , α - diethyl - α - hydroxyisopropyl)-, 635².
- , *N* - (β - ethyl - β - hydroxy - α - methylbutyl)-, 3254⁴.
- Cyclohexylamine, *N* - methyl-, benzoate, 511⁴.
- C₁₄H₂₁NO₂ Benzenesulfonamide, *N* - 2 - ethylcyclohexyl-, 1862².
- C₁₄H₂₁NO₃ 3 - Hexanone, 1 - (3,4 - dimethoxyphenyl)-, oxime, 2044¹.
- C₁₄H₂₁NO₂ Carbamic acid, (3 - ethoxy - 4 - methoxyphenethyl)-, ethyl ester, 2959².
- C₁₄H₂₁N₂O₂ Caprylaldehyde, *p* - nitrophenylhydrazone, 3261².
- C₁₄H₂₁N₂O₂ 3 - Pentanone, 1 - (3,4 - dimethoxyphenyl)-, semicarbazone, 2043².
- C₁₄H₂₁ Cyclohexene, 3 - cyclohexylidene - 2-ethyl-, 2042¹.
- π -Octane, phenyl-, 1222².
- C₁₄H₂₁ClNO₂ See *Sivaine*.
- C₁₄H₂₁N₂O₂ Carbamic acid, (diethylaminoethyl)-, benzyl ester, and -HCl, *P* 1757².
- Quinone, 2,5 - bis(*sec*-butylamino)-, 259⁴.
- , 2,5-bis(isobutylamino)-, 259⁴.
- p* - Toluic acid, 3 - amino-, diethylaminoethyl ester, and *ds* HCl, 1709².
- C₁₄H₂₁N₂O₃ Urea, α - (β , β - diethoxyisopropyl)- β -phenylthio-, 7710¹.
- C₁₄H₂₁N₂O₃ Benzenesulfonamide, *N,N*-dibutyl-*m*-nitro-, 642¹.
- C₁₄H₂₁N₂S Urea, α - (γ - methylhexyl) - β - phenylthio-, 464².
- C₁₄H₂₁N₄O₄ Tetraethylammonium picrate, 2440².
- C₁₄H₂₀O Anisole, *p*-heptyl-, 267¹.
- $\Delta^1,2$ - 6 γ Tridecatrienone, 8 - methyl-, 1247².
- C₁₄H₂₀O₂ Sapogenin from neutral saponin from *Polygala amara*, 489².
- C₁₄H₂₀O₂ Caproic acid, α - acetyl - α - allyl - β -keto - δ - methyl-, Et ester, 466⁷.
- Eganthic acid, α - acetyl - α - allyl - β - keto-, Et ester, 466⁷.
- C₁₄H₂₀O₂ Glutaric acid, α , γ - diacetyl - β - methyl-, di-Et ester, 246⁷.
- 1,2,4 γ Pentanetricarboxylic acid, 2 - hydroxy - 3,3 - diethyl-, γ - lactone, di-Et ester, 2329².
- C₁₄H₂₀O₇ Fructose, diacetone-, acetate-, 250⁴.
- Tricarballic acid, α - α acetyl-, tri-Et ester, 246⁷.
- C₁₄H₂₀O₂ Bimalonic acid, tetra-Et ester, *SnCl₄* addn. compds., 3251¹.
- C₁₄H₂₀O₂ Tartaric acid, dibicarbonate, tetra-Et ester, 468¹.
- C₁₄H₂₁IN Benzyltriethylammonium iodide, *CHI₃* addn. compd., 1403¹.
- C₁₄H₂₁P Benzyltriethylphosphonium iodide, *CHI₃* addn. compd., 1403¹.
- C₁₄H₂₁N Aniline, *N,N* - dibutyl-, 475², 2814⁴.
- C₁₄H₂₀N₂ Butyraldehyde, β - anilino-, di-Et acetal, 2343².
- C₁₄H₂₁NO₂ Benzenesulfonamide, *N,N* - diisobutyl-, 3478².
- C₁₄H₂₁NO₂ Benzenesulfonamide, 2(or 5) - heptyl - 5(or 2) - methoxy-, 267¹.
- C₁₄H₂₁N₂O Bornylene, 3 - propionyl-, semicarbazone, 1263⁷.
- C₁₄H₂₁ Anthracene, tetradecahydro-(?), 1271¹.
- Cyclohexene, 1 - cyclohexyl - 2 - ethyl-, 2042¹.
- C₁₄H₂₁N₂O₂ 3 - Pyrrolicarboxylic acid, 4 - (diethylaminomethyl) - 2,5 - dimethyl-, Et ester, -HCl, 2336⁷.
- C₁₄H₂₀O Cyclohexanol, 2 - cyclohexylidene - 1-ethyl-, 2941².
- C₁₄H₂₁O₂ Borneol, butyrate, 2657².
- $\Delta^1,2$ - Cyclohexanecetic acid, 5 - isopropyl-2-methyl-, Et ester, 2030⁴.
- Fenchyl alcohol, butyrate, 2657².
- Isoborneol, butyrate, 2657².
- C₁₄H₂₀O₂ Tartaric acid, monomethyl ester, 248².
- C₁₄H₂₀O₂ 2 - Propanone, 1,3 - dihydroxy-, Et cycloacetal, diacetate, 247².
- C₁₄H₂₁NO₂ Amine, m. 76², from diacetone-mannose and Me₂NH, 1561⁴.
- C₁₄H₂₁N₂O Camphane, 3 - propionyl-, semicarbazone, 1264¹.
- Ketone, 3 - isopentenyl - 2,2,3 - trimethylcyclopentyl methyl, semicarbazone, 2656².
- C₁₄H₂₁N₂O₂ Glycine, leucyltriglycyl-, 2503².
- C₁₄H₂₁N₂O₂ *s* - Triazine, 1,3,5 - triethylhexahydro-, uric acid salt, 538².
- C₁₄H₂₁ Bicyclohexyl, 2-ethyl-, 2042¹.
- C₁₄H₂₀O Cyclohexanol, 2 - cyclohexyl - 1 - ethyl-, 2941².
- C₁₄H₂₀O₂ Myristoleic acid, 2186².
- θ - Tetradecenoic acid, 2186².
- Tetradecylenic acid, 3606².
- C₁₄H₂₀O₂ Caproic acid, α - acetyl - α - butyl-, Et ester, 1244².
- Cyclohexanecetic acid, α - hydroxy-, hexyl ester, 982².
- , 1 - hydroxy - 5 - isopropyl - 2 - methyl-, Et ester, 2030⁴.
- C₁₄H₂₁N₂O Acetone, 4 - methylsemicarbazone, 1130¹.
- C₁₄H₂₁N₂O₂ Ketone, 3 - (α - hydroxyisopropyl)-3,2,3 - trimethylcyclopentyl methyl, semicarbazone, 2656².
- C₁₄H₂₁ 3 - Dodecene, 2,3 - dimethyl-, 2475¹.
- 4 - Tridecene, ϵ - methyl-, 2475¹.
- C₁₄H₂₁Br₂O₂ Piperazine salt of α -bromoisovaleric acid, *P* 76².
- C₁₄H₂₁N₂ Piperidine, 1,1' - (2,3' - butylene)bis-, and salts, 288².

- C₁₁H₁₃N₃O₂** Carbamic acid, (diethylaminoethyl)-, cyclohexylmethyl ester, P 1779.
C₁₁H₁₃N₂S₂ 2 - Picecoline, 1,1' - dithiodimethylenebis-, and -HCl, 2382.
C₁₄H₂₂O Myristaldehyde, 3261.
C₁₄H₂₂O 2 - Tetradecanone, 2807.
C₁₄H₂₂O₂ See *Myristic acid*.
C₁₄H₂₂O₄ Ipuroic acid, 3479.
C₁₄H₂₂AsI Allylethylbisobutylarsonium iodide, CHI₃ addn. compd., 1403.
C₁₄H₂₀N₂O₂ Eledonine, 20901.
C₁₄H₂₀N₂O₄ Piperazine salt of isovaleric acid, P 769.
C₁₁H₂₀O 3 - Dodecanol, 2,3-dimethyl-, 24751.
C₁₁H₂₀O 4 - Tridecanol, 4-methyl-, 2474.
C₁₄H₂₀O₂ 5,6 - Dodecanediol, 5 - ethyl-, 352.
C₁₄H₂₀O₂ 4,5 - Heptadecanediol, 4 - propyl-, 352.
C₁₄H₂₀O₂ Isobutyraldehyde, diisomyl acetal, 2474.
C₁₄H₂₀NO₂ Myristic acid, NH₄OH salt, 29287.
C₁₁H₇Br₂ClNO₄ Anthraquinone, 1,2,3,4 - tetrachloro - 6 - (dibromomethyl) - 5 - nitro-, 2045.
C₁₁H₇Br₂ClO₂ Anthraquinone, 1,2,3,4 - tetrachloro - 6 - (tribromomethyl) (?), 2045.
C₁₁H₇Cl₂NO₂ 2 - Anthraldehyde, 5,6,7,8 - tetrachloro - 9,10 - dihydro - 9,10 - diketone - 1-nitro-, 2015.
C₁₁H₇Br₂ClO₂ Anthraquinone, 1,2,3,4 - tetrachloro - 6 - (dibromomethyl) -, 2045.
C₁₁H₇Cl₂O₂ 2 - Anthraldehyde, 5,6,7,8 - tetrachloro - 9,10 - dihydro - 9,10 - diketone, 2015.
C₁₁H₇Cl₂O₄ 2 - Anthraquinonecarboxylic acid, 5,6,7,8 - tetrachloro-, and Na salt, 20461.
C₁₁H₇Cl₂NO₂ 2 - Anthraldehyde, 5,6,7,8 - tetrachloro - 9,10 - dihydro - 9,10 - diketone, oxime, 20461.
C₁₁H₇Cl₂NO₄ Anthraquinone, 1,2,3,4 - tetrachloro - 6 - methyl - 5 - nitro-, 2045.
C₁₁H₇Cl₂O₂ Anthraquinone, 1,2,3,4 - tetrachloro - 6 - methyl-, 2045.
C₁₁H₇K₂O₇ Iimodic acid, di-K deriv., K salt, 1861.
C₁₁H₇BrO₂ 2 - Anthraquinonecarboxylic acid, 3-bromo-, 2044.
C₁₁H₇Br₂ClO₂ Anthraquinone, 1 - chloro - 2 - dibromomethyl-, 499.
C₁₁H₇Br₂NO₂ Anthraquinone, 2 - dibromomethyl-1-nitro-, 2045.
C₁₁H₇NO₂ 2 - Anthraldehyde, 9,10 - dihydro - 9,10 - diketo - 1 - nitro-, 2015.
C₁₁H₇NO₂ 2 - Anthraquinonecarboxylic acid, 1 - nitroso- (?), 2045.
C₁₁H₇NO₂ 2,3,γ - Indenopyridine, 1,3,4 - tricarboxylic acid, 9-keto-, 4951.
C₁₁H₇Br₂O₂ 2 - Anthroic acid, 9,10 - dibromo-, 501.
C₁₁H₇Cl₂O₂ Coumarin, 6,8 - dichloro - 3 - phenyl-, 824.
C₁₁H₇Cl₂O₄ Benzoic acid, 2,3,4,5 - tetrachloro-6-*p*-tolyl-, 2045.
C₁₁H₇Cl₂O₄ Benzoic acid, 2,3,4,5 - tetrachloro-6-(2,3 cresotyl)-, 1268.
C₁₁H₇O₄ Anthraquinonecarboxylic acid, 500.
C₁₁H₇O₂ Emodic acid, 1860.
C₁₁H₇BrO₂ Anthraquinone, 2 - bromo - 3 - methyl-, 499, 2044.
C₁₁H₇BrO₂ 1 - Anthroic acid, 9(or 10) - bromo-, 500.
Coumarin, 6 - bromo - 3 - phenyl-, 824.
C₁₁H₇BrO₂ Benzoic acid, 6' - bromo - 2,3' - carbonylbis-, 2044.
C₁₁H₇ClO₂ Anthraquinone, chloromethyl-, 499.
Coumarin, 6 - chloro - 3 - phenyl-, 824.
Flavone, 2'-chloro-, 1863.
C₁₁H₇ClO₂ Flavone, 2' - chloro - 3 - hydroxy-, 1863.
C₁₁H₇F₂O₂ Anthraquinone, 1 - fluoro - 3 - methyl-, 2950.
C₁₁H₇NO₂ Anthraquinone, 2 - methyl- 1 - nitro-, 499, P 2210.
C₁₁H₇NO₂ 1 - Anthroic acid, 9(or 10) - nitro-, 500.
C₁₁H₇NO₂ 7,8 - Benzoquinoline - 6,7 - dicarboxylic acid, 2662.
C₁₁H₇NO₂ 2,3,γ - Indenopyridine - 1,3,4 - tricarboxylic acid, 495.
C₁₁H₇N₂O 8(2) - Indenotriazolone, 2 - phenyl-, 2954.
C₁₁H₁₀ Fluoranthene, 2333.
C₁₁H₁₀BrNO₂ 2(1) - Benzofuranone, 4 - bromo-5 - methoxy - 1 - phenylimino-, 2047.
C₁₁H₁₀BrN₂O₇ Imidazole, 4(or 5) - bromo - 5(or 4) - phenyl-, picrate, 1706.
C₁₁H₁₀BrN₂O₂ Carbonic acid, bis(5 - bromo-2 - nitro - *p*-tolyl) ester, 981.
C₁₁H₁₀Br₂O₂ Resorcinolglycerine, dibromo-, 1568.
C₁₁H₁₀Br₂N₂O₂ Hydrazine, α - acetyl - β - (m-nitrobenzyl) - α - (2,4,6 - tribromophenyl)-, 2939.
C₁₁H₁₀Br₂N₂O₄ Hydrazine, α - acetyl - β - (m-nitrobenzyl) - α - (2,4,6 - tribromophenyl)-, 2939.
C₁₁H₁₀Br₂N₂O₂ Benzophenone, 3,5,3',5' - tetrabromo - 4,4' - bis(methylnitramino)-, 1265.
C₁₁H₁₀Cl₂N₂O₂ Quinoxaline, 2 - (3,5 - dichloro-2 - hydroxy - *p*-anisyl)-, 2047.
C₁₁H₁₀Cl₂O Ethyl-, 1,5 - dichloro - 9 - anthryl methyl, 2489.
C₁₁H₁₀Cl₂N₂O₂ Hydrazine, α - acetyl - β - (m-nitrobenzyl) - α - (2,4,6 - trichlorophenyl)-, 2939.
C₁₁H₁₀Cl₂N₂O₄ Hydrazine, α - acetyl - β - (m-nitrobenzyl) - α - 2,4,6 - trichlorophenyl-, 2939.
C₁₁H₁₀IN Quinoline, 6 - iodo - 2 - phenyl-, 506.
C₁₁H₁₀I₂N₂O Oxindole, 5,7 - diiodo - 3 - (phenyliminomethyl)-, 1424.
C₁₁H₁₀N₂O 10 - Pseudoisindololbenzimidazolone, 3-methyl-, 830.
C₁₁H₁₀N₂O₂ Anthraquinone, 1(and 3) - (β - formylhydrazino)-, 1275.
C₁₁H₁₀N₂O₄ Glyoxylnitroic acid, phenyl-, Bz deriv., 2187.
C₁₁H₁₀N₂O₂ Stilbene, 3,4 - methylenedioxy-2',4' - dinitro-, 24861, 2953.
C₁₁H₁₀N₂O₂ Benzoic acid, 2,3' - methylenebis[5-nitro-, 3267.
C₁₁H₁₀N₂O₂ Nitrone, β - picryl - α - styryl-, 2039.
C₁₁H₁₀N₂O₂ Imidazole, 2' - (nitrophenyl)-, picrate, 987.
C₁₁H₁₀O₂ Anthraquinone, methyl-, 499.
C₁₁H₁₀O₂ Anthroic acid, 9,10 - dihydro - 9 - hydroxy-, lactone, 500.
Flavone, and *Pic* compd., 287, 288.
C₁₁H₁₀O₄ Anthraquinone, 9 hydroxymethyl-, 1325.
C₁₁H₁₀O₄ 2 - Anthroic acid, 9,10 - dihydroketo-, 500.
Coumarin, 7 - hydroxy - 3 - phenyl-, 824.
Resorcinolacrolein, 1568.
C₁₁H₁₀O₄ Anthraquinone, 1 - hydroxy - 2 - methoxy-, 3270.
Chrysin, 2341.
Chrysoptic acid, 2046.
1,2,α - Naphthopyran - 4 - acetic acid, 2-keto-, Na salt, 823.
C₁₁H₁₀O₄ Anthrapurpurin, 6 - methyl-, 2491.

- Anthraquinone, dihydroxymethoxy-, 1861¹, 3270¹.
 —, trihydroxymethyl-, 652², 2491³.
 Apigenin, 2341¹.
 Benzaldehyde, *m* - hydroxy-, carbonate, 2331¹.
 Frangulaemodin, 1860¹.
 Galangin, 2341¹.
 Morindone, 652².
 Pyrogallolacrolein, 1568¹.
 C₁₅H₁₀O₈ Anthraquinone, 1,3,8 - trihydroxy-6-methoxy-, 1861¹.
 Fisetin, 2341¹, 2758¹.
 Luteoflavin, 2341¹.
 Luteolin, 2341¹.
 C₁₅H₁₀O₇ (See also *Quercetin*.)
 Anthraquinone, pentahydroxy-2-methyl-, 2822¹.
 Morin, 2341¹.
 C₁₅H₁₀O₆ Myricetin, 1141¹, 2207¹.
 C₁₅H₁₀Br₂O₂ Methane, dibenzoyl-, compd. with BF₃, 220¹.
 C₁₅H₁₀BrN₂O₂ Quinoxaline, 2-(5-bromo-2-hydroxy-*p*-anisyl)-, 2047¹.
 C₁₅H₁₀BrN₂O₂ 2-Quinoxalinol, 3-(5-bromo-2-hydroxy-*p*-anisyl)-, 2047¹.
 C₁₅H₁₀BrO Anthrone, bromo-methyl-, 2950¹.
 C₁₅H₁₀BrO₂ Benzoic acid, *o*-(4-bromo-*m*-tolyl)-, 2044¹.
 C₁₅H₁₀BrN₂O Hydrazine, α -acetyl- α -(2,4-dibromophenyl)- β -(nitrobenzoyl)-, 2939¹.
 C₁₅H₁₀ClO 2-Phenylbenzopyrylium chloride, -HCl, 257¹.
 C₁₅H₁₀ClO₂ 5,7-Dihydroxy-2-(*p*-hydroxyphenyl)benzopyrylium chloride, 2341¹.
 3,5,7-Trihydroxy-2-phenylbenzopyrylium chloride, 654¹, 2341¹, 2342¹.
 C₁₅H₁₀ClO₂ Dihydroxy-2-(dihydroxyphenyl)benzopyrylium chloride, 2341¹.
 Pe'rgonidin, 654¹, 2342¹.
 2-Phenylbenzopyrylium perchlorate, 287¹.
 3,5,7-Trihydroxy-2-(*m*-hydroxyphenyl)benzopyrylium chloride, 2342¹.
 3,5,7-Trihydroxy-2-salicylbenzopyrylium chloride, 2342¹.
 C₁₅H₁₀ClO₂ Cyanidin, 654¹, 1141¹.
 2-(2,4-Dihydroxyphenyl)-3,5,7-trihydroxybenzopyrylium chloride, 654¹, 2341¹.
 C₁₅H₁₀ClO₂ 5,7-Dihydroxy-2-phenylbenzopyrylium perchlorate, 2341¹.
 3,5,7-Trihydroxy-2-(3,4,5-trihydroxyphenyl)benzopyrylium chloride, 1141¹.
 C₁₅H₁₀ClO₂ 5,7-Dihydroxy-2-(*p*-hydroxyphenyl)benzopyrylium perchlorate, 2341¹.
 C₁₅H₁₀Cl₂N₂O Hydrazine, α -acetyl- α -2,4-dichlorophenyl- β -(nitrobenzoyl)-, 2939¹.
 C₁₅H₁₀Cl₂O₂ 3,4-Xylenol, 2,5,6-trichloro-, benzoate, 267¹.
 C₁₅H₁₀FO₂ Benzoic acid, *o*-(2-fluoro-*p*-tolyl)-, 2956¹.
 C₁₅H₁₀IO₂ 5,7-Dihydroxy-2-phenylbenzopyrylium iodide, 2341¹.
 C₁₅H₁₀IO₂ + 3H₂O 3,5,7-Trihydroxy-2-phenylbenzopyrylium iodide, -HI, 2341¹.
 C₁₅H₁₀N₂O 3-Indolealdehyde, 2,3-dihydro-5,7-dilido-2-keto-, phenylhydrazine, 1492¹.
 C₁₅H₁₀N Acenaphthopyridine, 2662¹.
 C₁₅H₁₀NO Quinoline, 2-phenoxo-, 68¹.
 2(1)-Quinolone, 1-phenyl-, 68¹.
 α -Tol-nitrile, α -benzoyl-, 2822¹.
 C₁₅H₁₀NO₂ Isoxazole, 5-(*p*-hydroxyphenyl)-3-phenyl-, 1495¹.
o-Tolunitrile, α -hydroxy-, benzoate, 2815¹.
 C₁₅H₁₀N₂O 2(1)-Benzofuranone, 5-methoxy-1-phenylimino-, 2047¹.
 2,3,7-Indenopyridine-4-carboxylic acid, 9-keto-1,3,6-dimethyl-, and sulfate, 495¹.
 C₁₅H₁₀N₂O Phthalonanilic acid, 2654¹.
 C₁₅H₁₀NO₂ *o*-Toluenesulfonic acid, α -(2-keto-5(2)-indylidene)-, *Na salt*, 2204¹.
 C₁₅H₁₀NO₂ Anthraquinone, 3-amino-1,8-dihydroxy-6-methoxy-, 1861¹.
 C₁₅H₁₀NO₂ Benzoic acid, 5-nitro-2,2'-methylenebis-, 267¹.
 C₁₅H₁₀N₂ 3-Indazolenitrile, 2-*p*-tolyl-, 2339¹.
 C₁₅H₁₀N₂O 3-Indazolenitrile, 2-*p*-tolyl-, 1-oxide, 2339¹.
 C₁₅H₁₀N₂O Pyrazinoacid-1(2)-one, 3,7-dihydro-3-nitro-, 295¹.
p-Tolunitrile, α -(*p*-aminobenzal)-3-nitro-, 1420¹.
 C₁₅H₁₀N₂O Indazole, methyl(nitrobenzoyl)-, 5124¹.
 C₁₅H₁₀N₂O 5-Benzimidazolecarboxylic acid, 2-methyl-7-nitro-1-phenyl-, 2824¹.
 2,1,3-Benzotriazole-2,5'-salicylic acid, acetate, 514¹.
 Pseudoisatin, 6-nitro-1-phenyl-, oxime Me ether, 646¹.
 C₁₅H₁₀N₂O Indene, picrate, 493¹.
 C₁₅H₁₀N₂O₂ Thiazole, 2-amino-5-(*p*-nitrophenylazo)-4-phenyl-, 513¹.
 C₁₅H₁₀ Compd., m. 202-3°, from atromentin, 639¹.
 Phenanthrene, 9-methyl-, 499¹.
 C₁₅H₁₀BrNO Nitron, *N*-(*p*-bromophenyl)- α -styryl-, 1259¹.
 C₁₅H₁₀BrN₂O Hydrazine, α -acetyl- α -(*p*-bromophenyl)- β -(nitrobenzoyl)-, 2939¹.
 C₁₅H₁₀BrN₂O Indazole, 3-bromo-2,5-dimethyl-, picrate, 512¹.
 C₁₅H₁₀BrN₂O Hydrazine, α -acetyl- β -benzoyl- α -(2,4-dibromophenyl)-, 2332¹.
 C₁₅H₁₀Br₂O Bibenzyl, α , α' -dibromo-3,4-methylenedioxy-, 2486¹.
 C₁₅H₁₀Br₂O Carbonic acid, *o*bis(bromo-*p*-tolyl) ester, 981¹.
 C₁₅H₁₀ClNO Nitron, *N*-(*p*-chlorophenyl)- α -styryl-, 1259¹.
 C₁₅H₁₀ClN₂ 1,2,3-Triazole, 5-chloro-4-phenyl-1-*p*-tolyl-, 987¹.
 C₁₅H₁₀ClN₂O Benzoic acid, *o*-(β -(β -anilino- α -chloro- β -ketoethylidene)hydrazinyl)-, 43¹.
 C₁₅H₁₀ClN₂O Hydrazine, α -acetyl- α -*p*-chlorophenyl- β -*p*-nitrobenzoyl-, 2939¹.
 C₁₅H₁₀Cl₂O₂ Xylenol, dichloro-, benzoate, 267¹.
 C₁₅H₁₀N₂ 3- β , β -Pseudonaphthazole-2-nitrile, 3,3-dimethyl-, 2209¹.
 Pyrazole, diphenyl-, 2048¹.
 C₁₅H₁₀N₂O Acridine, 1-acetamido-, 295¹.
 Benzamide, *N*-(α -cyanobenzyl)-, 263¹.
 1,2-Indandione, phenylhydrazine, 66¹.
 Isoindazole, 1-acetyl-3-phenyl-, 510¹.
 Pyrazinoacid-1(2)-one, 3,7-dihydro-, 295¹.
 4(3)-Quinoxalone, 2-methyl-3-phenyl-, -HCl, 645¹.
 C₁₅H₁₀N₂O 1-Acridineglycine, 295¹.
 Anthranilic acid, *N*-(*o*-aminophenyl)-, cyclic amide, acetyl deriv., 294¹.

- 2-Benzimidazole-*o*-ic acid, 5-methyl-, 830^a.
- 3-Indazolecarboxylic acid, 2-*p*-tolyl-, 2339^a.
- Oxamide, *N*, *N'*-(*p*, *p'*-methylenediphenyl)-(?), 3267^a.
- 2-Phenazolin, methyl-, acetate, 643^a.
- C₁₅H₁₁N₂O: 1-Acridanglycine, 5-keto-, 294^a.
- Carbazole, nitropropionyl-, 2492^a.
- Furazan, 3-*p*-anisyl-4-phenyl-, *N*-oxide, 2819^a.
- 2-Quinoxalinol, 3-(2-hydroxy-*p*-anisyl)-, 2047^a.
- C₁₅H₁₁N₂O: Benzophenone, *p*-nitro-, acetyloxime, 490^a.
- Nydantoin, bis(*p*-hydroxyphenyl)-, 637^a.
- p*-Toluic acid, *α*-(*p*-aminobenzal)-3-nitro-, and salts, 1420^a.
- o*-Toluidine, 5-nitro-*α*-piperonylidene-, 2959^a.
- C₁₅H₁₁N₂O: Creosol, *α*-(2,4-dinitrobenzal)-, 2959^a.
- Guaiacol, 4-(2,4-dinitrostyryl)-, 2485^a.
- C₁₅H₁₁N₂O: Isoxazole, 4-nitroso-5-phenyl-3-phenylhydrazino-, 469^a, 2187^a.
- 1,2,4-Oxadiazole, benzoylphenylhydrazino-, 469^a, 2188^a.
- 1,2,5-Triazole, 3-methyl-4-(*o*-nitrophenyl)-1-phenyl-, 293^a.
- C₁₅H₁₁N₂O: 1,2,3-Benzotriazole-5-carboxylic acid-7-acetamido-1-phenyl-, 2825^a.
- C₁₅H₁₁N₂O: Thiazole, 2-amino-4-phenyl-5-*p*-sulfonyl-, 513^a.
- C₁₅H₁₁N₂O: Indazole, 3-acetyl-, 2,4-dinitrophenylhydrazono-, 508^a.
- C₁₅H₁₁N₂O: 1,4,5-Isotriodiazine, 2-amino-5-phenyl-, picate, 831^a.
- C₁₅H₁₁O: Chalcone, 1259^a, 3064^a.
- Fluorene, 9-(methoxymethylene)-, 2334^a.
- C₁₅H₁₁O: 1(2)-Benzofuranone, methyl-2-phenyl-, 1270^a, 2044^a.
- Chalcone, hydroxy-, 287^a, 3064^a.
- 3-Chromanone, 4-phenyl-, 286^a.
- Flavanone, 287^a.
- Propanedione, diphenyl-, 220^a, 1419^a.
- Stilbene, 3,4-methylenedioxy-, 2486^a.
- C₁₅H₁₁O: 5-Benzofuranol, 1,2-dihydro-, benzoate, 1421^a.
- Benzoic acid, *o*-tolyl-, 1267^a, 2488^a.
- Chalcone, 4,4'-dihydroxy-, and *HCl*, 1414^a.
- C₁₅H₁₁O: Benzil, 2,4-dihydroxymethoxy-, 2946^a.
- Resorcinolglycerin, 1568^a.
- C₁₅H₁₁O: Benzil, 2,4,6-trihydroxymethoxy-, 2946^a.
- Rhamnicogenol, 2108^a, 3562^a.
- C₁₅H₁₁O: Pyrogallolglycerin, 1568^a.
- C₁₅H₁₁ClNO: Phenarsazone, 1-chloro-1,6-dihydro-6-*p*-propionyl-, 478^a.
- C₁₅H₁₁BrNO: Oxazolidine, 2-(*p*-bromophenylimino)-3-phenyl-, 2481^a.
- , 3-(*p*-bromophenyl)-2-phenylimino-, 2481^a.
- C₁₅H₁₁BrN₂S: Thiazolidine, 2-(*p*-bromophenylimino)-3-phenyl-, 2481^a.
- , 3-(*p*-bromophenyl)-2-phenylimino-, 2481^a.
- C₁₅H₁₁BrO: Acetophenone, *α*-(*p*-bromo-*o*-toloxy)-, 1260^a.
- 3-Chromanol, 4-bromo-4-phenyl-, 286^a.
- C₁₅H₁₁BrNO: *p*-Phenetidine, *N*-(3,5-dibromosulcyl)-, 259^a.
- C₁₅H₁₁ClO: Acetyl chloride, *o*-anisylphenyl-, 286^a.
- 3,4-Xylenol, 5-chloro-, benzoate, 267^a.
- C₁₅H₁₁NO: Acetophenone, *g*-(imine)methyl-*α*-phenyl-, 2822^a.
- Benzoxazole, 3,6-dimethyl-1-phenyl-, 2340^a.
- Chalcone, 3(and 4)-amino-, and salts, 1268^a.
- Ketone, carbaryl ethyl-, 2492^a.
- Nitron, *N*-phenyl-*α*-styryl-, 1258^a.
- C₁₅H₁₁NO: Benzamide, *N*-phenacyl-, 263^a.
- Δ²-Isoxazoline, 5-(*p*-hydroxyphenyl)-3-phenyl-, 1415^a.
- C₁₅H₁₁NO₂: (See also *Akimate*.)
- Benzanilide, hydroxy-, acetate, 1417^a.
- Benzil, *p*-methoxy-, oxime, 1859^a, 2819^a.
- Benzoic acid, *p*-(*p*-anisalamino)-, 1416^a.
- Cresotamide, benzoate, 1416^a, 1417^a.
- , *N*-benzoyl-, 1416^a, 1417^a.
- Phthalamic acid, *N*-benzyl-, 3260^a.
- C₁₅H₁₁NO₂: 2(1)-Benzofuranone, 1-anilino-1-mercapto-5-methoxy-, 2048^a.
- C₁₅H₁₁NO: Benzoic acid, *o*-methoxy-, salicyl-amide ester, 1416^a.
- Carbamic acid, hydroxy-, tolyl ester, benzoate, 3258^a.
- Salicylamide, *N*-*o*-methoxybenzoyl-, 1416^a.
- α*-Toluanilide, *α*-hydroxy-3,4-methylenedioxy-, 264^a.
- 2,5-Xylenol, 6-nitro-, benzoate, 2340^a.
- C₁₅H₁₁N₂O: 1,2,3-Triazole-5-ol, 4-phenyl-1-*p*-tolyl-, 988^a.
- C₁₅H₁₁N₂O: Isoindazole, 4-nitro-1-(2,4-xylyl)-, 3092^a.
- C₁₅H₁₁N₂O: 1,4,3-Isotriodiazine, 5-phenyl-2-phenylsulfonamido-, 832^a.
- C₁₅H₁₁N₂O: Glyoxylic acid, *p*-nitrophenylazo-, Me ester, phenylhydrazono-, 1852^a.
- C₁₅H₁₁N₂O: Nitron, *α*-(dimethylaminophenyl)-*N*-picryl-, 2039^a.
- C₁₅H₁₁: Stilbene, *α*-methyl-, 2334^a.
- C₁₅H₁₁AsNO: Phenazarsinic acid, 6-propionyl-, 478^a.
- C₁₅H₁₁BrNO: *m*-Benzanilide, 4-bromo-6-methyl-, 2338^a.
- C₁₅H₁₁ClN: (Chlorobenzyl)methylindazolium iodide, 3091^a.
- C₁₅H₁₁ClNO₂: Tolu-*m*-toluide, 5'-chloro-6'-hydroxy-, 1562^a.
- C₁₅H₁₁ClNO₂: *m*-Acetotoluide, 5-chloro-6-hydroxy-, benzenesulfonate, 1562^a.
- m*-Benzenesulfonotoluide, 5'-chloro-6'-hydroxy-, acetate, 1562^a.
- C₁₅H₁₁ClNO: Glyoxylanilide, *α*-chloro-, tolylhydrazono-, 43^a.
- C₁₅H₁₁HgO₂: *p*-Tolylmercuric carbonate, 465^a.
- C₁₅H₁₁IN₂O: Methylmethylbenzylindazolium iodide, 3091^a.
- C₁₅H₁₁N: Acridine, 1-ethylamino-, 295^a.
- Indazole, benzylmethyl-, 511^a, 512^a.
- Isoindazole, benzylmethyl-, 512^a.
- Pyrazinoacridine, 2,3,7-tetrahydro-, 295^a.
- C₁₅H₁₁N₂O: Acetaldehyde, benzoyl-, phenylhydrazono-, 2048^a.
- Acridan, 1-acetamido-, 295^a.
- Acridine, 1-(*β*-hydroxyethylamino)-, 295^a.
- Anthranilic acid, *N*-(*p*-aminophenyl)-*N*-ethyl-, cyclic amide, 987^a.
- Oxazolidine, 3-phenyl-2-phenylimino-, 2481^a.

- δ - β, β - Pseudonaphthazole - 2 - aldehyde, (3,3 - dimethyl-, *o*-me, 2209⁸.
 Δ^1 - 5 - Pyrazolinol, 1,3 - diphenyl-(?), 2048⁸.
 C₁₁H₁₁N₂O₂ Benzanilide, *o* - acetamido-, 645⁷.
 Indanamine, *N* - *m*(and *p*) - nitrophenyl-, 1590⁸.
 3 - Indoleacrylic acid, α - cyano-2-methyl-, *Et* ester, 505¹.
 C₁₁H₁₁N₂O₂ Benzil, β - methoxy-, dioxime, 2819⁴.
 Nitron, α - (nitrophenyl) - *N* - 2,5 - xyl-, 1259¹.
o - Tolidine, α - *p* - anisal - 4 - nitro-, 491⁴.
 C₁₁H₁₁N₂O₂ 2(1) - Behzofuranone, 1 - (*p* - amisonilino) - 1 - mercapto - 5 - methoxy-, 2048¹.
 C₁₁H₁₁N₂O₂ Aniline, *N* - (nitro - *o* - veratral)-, and -HCl, 482⁴.
 Anthranilic acid, *N* - [*o* - (carboxymethyl)-aminophenyl]-, 294⁸.
 —, *N* - ethyl - *N* - (*o* - nitrophenyl)-, 987⁶.
 C₁₁H₁₁N₂O₂ 2 - Pappanone, 1 - (*o* - nitrophenyl)-, benzenesulfonate of oxime, 2938⁸.
 C₁₁H₁₁N₂O₂ Benzothiazole, 4 - methyl - 1 - *m*-toluino-, and chloroplatinate, 1411⁴.
 C₁₁H₁₁N₂O₂ 1.1'(2,2') - Spirobenzothiazole, 2,2' - dimethyl-, 289⁸.
 C₁₁H₁₁N₂O₂ Isoxazole, 4 - amino - 5 - phenyl-3-phenylhydrazino-, 469⁷, 2187⁸.
 C₁₁H₁₁N₂O₂ Glyoxime, benzoylphenylhydrazino-, 469⁴.
 1,2 - Propanedione, 1 - (*o* - nitrophenyl)-, 1 - oxime, 2 - phenylhydrazone, 2938⁸.
 C₁₁H₁₁N₂O₂ Benzaldehyde, 2,6¹ - dinitro-, xyl-, hydrazone, 3092³.
 C₁₁H₁₁N₂O₂ Phenazine, 6 - dimethylamino - 2 - methyl - 3 - triazo-, 644⁸.
 C₁₁H₁₁N₂O₂ 3,5-Pyrazoledione, 1-(nitrophenyl)-(?) nitrophenylhydrazine addn. compd., 1255¹.
 5 - Pyrazolone, 3-hydroxy - 1 - (nitrophenyl)-(?) nitrophenylhydrazine addn. compd., 1255¹.
 C₁₁H₁₁N₂O₂ Guanidine, α (or β) - benzoyl - γ (or α) - methyl-, picrate, 1853⁷.
 C₁₁H₁₁N₂O₂ Bezofuran, 1,2 - dihydro - 1 - methyl-2-phenyl-, 1566⁴.
 Benzophenone, 2,4 - dimethyl-, 499⁷.
 Fluorene, 9-methoxy-9-methyl-, 2334⁴.
 Phenol, *o*-phenylallyl-, 1566¹, 2038⁸.
 2 - Propanone, 1,1 - diphenyl-, 636¹, 3486¹.
 Propene oxide, 1,1 - diphenyl-, 3486¹.
 C₁₁H₁₁O₂ Acetophenone, α - *p* - anisyl-, 1858⁸.
 Benzoin, α -methyl-, 1701¹.
 Chromanol, phenyl-, 286⁷.
 Guaiacol, 4 - styryl-, 2485⁴.
 C₁₁H₁₁O₂ Acetic acid, *o* - anisylphenyl-, 286⁷.
 —, methoxydiphenyl-, 2650⁴.
 Acetophenone, α - (α - hydroxy - *o*-toloxy)-, 1660⁴.
 —, α - (*m* - methoxyphenoxy)-, 1260⁴.
 Mandelic acid, α - benzyl-, 1419⁴.
p - Toluic acid, α - hydroxy-, benzyl ester, 1417⁴.
 C₁₁H₁₁O₂ Acid from the marking nut, 3607¹.
 Propiophenone, β - (dihydroxyphenyl)-2,4-dihydroxy-, 2039¹.
 C₁₁H₁₁O₂ (See also *Catechol*.)
 3,5 - Benzoylrandiol, 1,2 - dihydro - 4 (and δ) - (α ,3,4 - trihydroxybenzyl)-, 484⁴.
 4,5,7,3',4'-Flavapentol, 423⁸.
 C₁₁H₁₁BrN₂O₂ Carbanilide, bromo - α - (β hydroxyethyl)thio-, 2484⁴.
 C₁₁H₁₁BrN₂O₂ *p* - Toluenesulfonanilide, *N* - (α , β - dibromethyl)-, 282⁸.
 C₁₁H₁₁BrCrO₂ 2459¹.
 C₁₁H₁₁ClN₂O₂ Carbanilide, 2 - chloro - 4,6 - dimethyl-, 2341¹.
 C₁₁H₁₁IN₂O₂ 2 - (α - Benzoylacetaimido) - 1 - methylpyridinium iodide, 1574¹.
 C₁₁H₁₁N₂O₂ Benzalimine, α - benzyl - *o* - methyl-, 2817¹.
 Indanamine, *N*-phenyl-, 1520⁸.
 Phenethylamine, *N*-benzal-, 990⁴.
 Pseudonaphthazole, 2,3,3 - trimethyl-, and -H₂, 2209¹, 2210¹.
 C₁₁H₁₁N₂O₂ Acetamide, *N* - methyl - α , α - diphenyl-, 1255⁷.
 Benzophenone, β - dimethylamino-, 1265⁷; *perchlorate*, 1266⁷.
 —, 2,5 - dimethyl-, oxime, 1405⁸.
 Nitron, α - phenyl - *N* - 2,5 - xyl-, 1259¹.
 Propiophenone, β - phenyl-, oxime, 982⁷.
 C₁₁H₁₁N₂O₂ Acetanilide, *o* - (benzylmercapto)-, 1423⁷.
 C₁₁H₁₁N₂O₂ Acetanilide, *o* - benzyloxy-, 1423⁷.
 Acetophenone, α - *p* - anisyl-, oxime, 1858⁸.
p - Anisidine, *N* - anisal-, 637⁷.
 Benzanilide, *N* - (β - hydroxyethyl)-, 283⁷.
 2,5 - Benzoxylide, 6' - hydroxy-, 2340⁸.
 1,3(2,4) - Isoquinolinedione, 4,4 - diethyl-, 375⁷.
 Nitron, α - *p* - anisyl - *N* - *p* - tolyl-, 1258⁸.
 C₁₁H₁₁N₂O₂ *p* - Toluenesulfonanilide, *N*-vinyl-, 282⁸.
 C₁₁H₁₁NO₂ Ether, methyl (β - nitro - α , α - diphenylethyl)-, 491⁴.
 C₁₁H₁₁N₂O₂ Acridine, diaminoethoxy-, hydrochloride—see *Rivanol*.
 3 - β, β - Pseudonaphthazone - 2 - carboxamide, 3,3 - dimethyl-, oxime, 2209⁸.
 α - Toluamide, *N* - *p* - tolylmino, oxime, 3262¹.
 C₁₁H₁₁N₂O₂ (See also *Methyl red*.)
 Benzoin, semicarbazone, 2660¹.
 2 - Propanone, 1 - (*o* - nitrophenyl)-, phenylhydrazone, 2938⁸.
 α - Toluic aldehyde, β - methyl-, β - nitrophenylhydrazone, 3261¹.
 C₁₁H₁₁N₂O₂ Anthranil, 3,4,6,6 - tetrahydro-6 - methyl - 2 - *p* - nitrobenzylamino-, 1263¹.
 C₁₁H₁₁N₂O₂ Benzaldehyde, 2,4 - dimethoxy - 5 - nitro-, phenylhydrazone, 1701¹.
 Dibenzylamine, *N* - methylidinitro-, and salt, 3261¹.
o - Veratraldehyde, nitro-, phenylhydrazone, 482⁴.
 C₁₁H₁₁ Methane, β - *p* - tolyl-, 2480⁷.
 C₁₁H₁₁AsIO₆ Ethyl - *o* - methylphenoxarsonium iodide, 2038⁷.
 C₁₁H₁₁ClN₂O₂ *p* - Toluenesulfonanilide, *N* - (β - chloroethyl)-, 282⁸.
 C₁₁H₁₁ClN₂O₂ See *Rivanol*.
 C₁₁H₁₁INO₂ *p* - Toluenesulfonanilide, *N* - (β - iodoethyl)-, 282⁸.
 C₁₁H₁₁N₂O₂ Acetanilide, α - anilino - *N* - methyl-, 3063⁷.
 Acridan, 1 - (β - hydroxyethylamino)-, 295⁸.
 Acridine, aminotetrahydro-, *Ac* deriv., 521¹.
 Aniline, *N* - nitroso - *N* - (γ - phenylpropyl)-, 1288⁷.
 Butyraldehyde, α - 2 - fural-, phenylhydrazone, 1139¹.
 Carbanilide, dimethyl-, 642⁸.

- Δ¹ - Cyclohexanenitrile, 2 - benzamido - 3-methyl-, 1263¹.
 Hemipyrocyanin, Et ether, and *chloroaurate*, 1864⁴.
 Ketone, 1-methyl-2-pyrrolidyl-4-quinolyl-, *-HCl*, 656⁹.
 —, 2-piperidyl-4-quinolyl-, 657¹.
 Urea, *s*-dibenzyl-, 642².
 C₁₁H₁₁N₂O₈ Carbanilide, *p*-ethoxythio-, 57⁴.
 —, α-(β-hydroxyethyl)thio-, 2481¹.
 C₁₁H₁₁N₂O₅ 5(10) - Acridone, amino - 1,2,3,4-tetrahydro-, Ac deriv., 521⁷.
 Anthranil, 2-benzamido-3,4,5,6-tetrahydro-6-methyl-, 1263¹.
 Anthranilic acid, *N*-(*o*-aminophenyl)-*N*-ethyl-, and *Ag salt*, 987².
 Carbanilide, *p*-ethoxy-, 57⁴.
 C₁₁H₁₁N₂O₈ Benzenesulfonanilide, *m*-nitro-*N*-propyl-, 642².
 C₁₁H₁₁N₂S Carbanilide, dimethylthio-, 284⁴, 2481¹, 2646⁹.
 C₁₁H₁₁N₄ Formaldehyde, phenylazo-, 2,4-xylylhydrazone, 2852².
 C₁₁H₁₁N₄O Acetophenone, δ-anilinosemicarbazone, 482².
 C₁₁H₁₁N₄O₂ Indazole, 4,5,6,7-tetrahydro-7-methyl-3-*p*-nitrobenzalamino-, 1263¹.
 3,5-Pyrazolodione, 1-phenyl-(?), phenylhydrazine addn. compd., 1254⁴.
 5-Pyrazolone, 3-hydroxy-1-phenyl-(?) phenylhydrazine addn. compd., 1254⁴.
 C₁₁H₁₁N₄O₂ Pyridine, 2,6-diethyl-, picrate, 2667⁴.
 —, 3-ethyl-, 2,6-dimethyl-, picrate, 1573².
 C₁₁H₁₁N₄O₄ Phenethylamine, *m*-methoxy-, picrate, 900¹.
 C₁₁H₁₁N₄O₄ 3-Pyrrolepropionic acid, 2,4-dimethyl-, picrate, 2336².
 C₁₁H₁₁N₄S Thiazole, 5,5'-benzalb[2-amino-4-methyl-, 512².
 C₁₁H₁₁N₄O₈ Carbohydrazide, α,δ-bis(phenyl-carbathyl)thio-, 2206².
 C₁₁H₁₁N₄O₂ Acetimidic acid, β-methyl-β-phenylhydrazide, picrate, 256².
 C₁₁H₁₁O Benzohydrol, *p*,α-dimethyl-, 645⁴.
 Ether, phenyl γ-phenylpropyl-, 2038².
 1-Propanol, 1,3-diphenyl-, 2331¹.
 Sesquiterpene alcohol from Manchurian poplar buds, 705¹.
 C₁₁H₁₁O₂ Hydrobenzoin, α-methyl-, 491⁷.
 1,2-Propanediol, 1,3-diphenyl-, 3262².
 C₁₁H₁₁O₂ Artemisic acid, 2822².
 C₁₁H₁₁O₂ Kawaic acid, 1706².
 Lactone ester, bp 140-50°, from α-acetyl-β-phenylethylene oxide, and the mono-Na deriv. of di-Et malonate, 2644⁴.
 Malonic acid, (5,6,7,8-tetrahydronaphthylmethyl)-, and salts, 1273^{1,2}, 1274⁴.
 C₁₁H₁₁O₂ See *Esculin*.
 C₁₁H₁₁AsI₄ Dimethyldiphenylarsonium iodide, CHI₃ addn. compd., 1403².
 C₁₁H₁₁BrN₂O Ketone, α-amino-α-bromoamyl-4-quinolyl, *di-HBr*, 657¹.
 C₁₁H₁₁HgNO₂ *o*-Acetotoluide, 3,4,6-tris(hydroxymercuri) triacetate, 2647².
 C₁₁H₁₁IN₄ 2,1,3-Benzotriazole, 2-(*p*-dimethylaminophenyl)-, methiodide, 514².
 C₁₁H₁₁N Aniline, *N*-(γ-phenylpropyl)-, and salts, 1258².
 Benzylamine, *N*-ethyl-*N*-phenyl-, 2646¹.
 Dibenzylamine, *N*-methyl-, and *-HCl*, 2261¹.
 β,β-Naphthazoline, 2,3,3-trimethyl-, 2209⁷.
 C₁₁H₁₁NO Benzohydrol, α-(α-aminoethyl)-, 1138¹; and *-HCl*, 635².
 C₁₁H₁₁NO₂ *p*-Toluenesulfonamide, *N*-benzyl-*N*-methyl-, 3266².
 C₁₁H₁₁NO₂ 6,1,5-Thiopyranopyridine-3-carboxylic acid, 4-ethyl-1,7-dihydro-5,7-diketo-γ,2-dimethyl-7-thio-, Et ester, and salts, 2497².
 C₁₁H₁₁NO₂ Indanol, amino-, benzenesulfonate, 2928².
 C₁₁H₁₁NO₂ Malonic acid, allyl[(*N*-methylbenzamido)methyl]-, 3084⁴.
 C₁₁H₁₁N₂O₂ Anthranil, 2-dimethylamino-3,4,5,6-tetrahydro-, picrate, 1262².
 C₁₁H₁₁AsBr₂ Ethylmethylphenylarsonium bromide, 1403².
 C₁₁H₁₁Br₂O₂ 3-Octanone, 1,2-dibromo-(3,4-methylenedioxyphenyl)-, 476².
 C₁₁H₁₁Br₂O₄ Glutaric acid, α,γ-dibromo-β-phenyl-, di-Et ester, 2643².
 C₁₁H₁₁Br₂CrO₄, 2459⁴.
 C₁₁H₁₁Br₂Cl₂N₂W₂, 618⁴.
 C₁₁H₁₁ClNO Tyrosyl chloride, *N*,*O*-dicarboxy-, 1248⁷.
 C₁₁H₁₁Cl₂N₂W₂, 618⁴.
 C₁₁H₁₁IN₂ Benzylmethylphenylammonium iodide, 1403².
 C₁₁H₁₁N₂ 2,2-Propanediamine, *N*,*N'*-diphenyl-, 492¹.
 C₁₁H₁₁N₂O₂ 1-Hydantoinacetic acid, 5-*p*-hydroxybenzyl-3-methyl-, Et ester, 636².
 C₁₁H₁₁N₂O₂ Cresorcinol, 2,6-diacetamido-, diacetate, 2649².
 C₁₁H₁₁N₂O Cyclohexanenitrile, 1-benzyl-2-keto-, semicarbazone, 1262².
 C₁₁H₁₁N₂O₂ Addn. compd. of protocatechuic acid and piperazinedione, 585².
 C₁₁H₁₁N₂O₂ Oxazole, 5-ethoxy-4-isopropyl-2-methyl-, picrate, 2051².
 C₁₁H₁₁O Propiophenone, α,α-diallyl-, 1134¹.
 C₁₁H₁₁O₂ 9-Phenanthrenecarboxylic acid, 1,2,3,4,5,6,7,8-octahydro-, and *Ag salt*, 1274⁷.
 C₁₁H₁₁O₂ Desmotroposantonin, 2822².
 2-Heptanone, 1-piperonylidene-, 470².
 Santonin, 126².
 C₁₁H₁₁O₂ Δ¹-3-Heptenol, acid phthalate, 2331¹.
 C₁₁H₁₁O₂ 1,2-Cyclopropanedicarboxylic acid, 1-ethoxy-3-phenyl-, di-Me ester, 2643².
 C₁₁H₁₁NO Acridine, octahydro-, Ac deriv., 522¹.
 Cyclohexanone, 2-*p*-dimethylamino-benzal-, 1263¹.
 C₁₁H₁₁NO₂ (See also *Tropaeocaine*.)
 Anthranilic acid, *N*-(3-methylcyclohexylidene)-, Me ester, 52².
 Δ²-4-Heptenone, 6-benzamido-2-methyl-(?), 968².
 1,3(2,4)-Isoquinalinedione, 4,4-dipropyl-, 376¹.
 Propiolic acid, phenyl-, β-diethylaminoethyl ester, 653².
 4-Pyridol, 1-benzoyltetrahydro-2,2,6-trimethyl-, 968².
 C₁₁H₁₁NO₂ 2-Heptanone, 1-piperonylidene-, oxime, 470².
 C₁₁H₁₁NO₂S Pseudocumidine, benzenesulfonate, 651².

- C₁₅H₁₇NO₅S** Malonanilic acid, α - acetyl - p - ethoxy - β - thio-, Et ester, 4717.
C₁₅H₁₇NO₅ Glutaric acid, α , α - keto - β - phenyl-, di-Et ester, oxime, 2208.
C₁₅H₁₇NO₅ 2 - Pyrroloacrylic acid, α ,4 - dicarboxy-, 3,5 - dimethyl-, di-Et ester, 2663.
C₁₅H₁₇NO₅ Tyrosine, N,O - dicarboxy-, 1245.
C₁₅H₁₇N₂O 1(2) - Anthracenone, hexahydro-, semicarbazone, 1273.
 Cyclohexanone, 2 - benzal - 6 - methyl-, semicarbazone, 2934.
 Cyclohexenone, dimethyl-, phenylsemicarbazone, 3485.
 Phenanthrone, hexahydro-, semicarbazone, 1273, 1274.
C₁₅H₁₅BrNO₂ Δ^7 - 1 - Octenol, 7 - bromo-, phenylurethane, 633.
C₁₅H₁₅N₂S Camphothiazole, 2 - methyl-, methiodide, 1706.
C₁₅H₁₅N₂ Methiodide of product from dimethylpyrone and N₂H₄, 2823.
C₁₅H₁₅N₂O Acridine, aminooctahydro-, Ac deriv., 521.
 Urea, α - (1,2,3,4,5,6,7,8 - octahydro-1-anthryl)-, 1272.
 —, α - (1,2,3,4,5,6,7,8 - octahydro-1-phenanthryl)-, 1274.
C₁₅H₁₅NO₂ Cyclohexanol, 3 - dimethylamino-, p - nitrobenzoate, -HCl, 2196.
 Dinicotinic acid, 2 - cyano - 1,2 - dihydro 1,2,6 - trimethyl-, di-Et ester, 2496.
C₁₅H₁₅N₂O₄ Quinoline, 1 - acetyl - 1,2,3,4 - tetrahydro - 5,8 - dimethoxy - 2,4 - dimethyl-6-nitro-, 2344.
C₁₅H₁₅N₂O₄ Physostigmine, nitroso-, 289, 1426.
C₁₅H₁₅N₂O₄ Conhydrinone, methyl-, picrate, 1280.
C₁₅H₁₅O γ - Pentenophenone, α,α - diethyl-, 1134.
C₁₅H₁₅O₂ Δ^1 - 2 - Heptenal, 6 - methyl-, benzoate, 2931.
C₁₅H₁₅O₂ Δ^1 - 3 - Octenone, 1 - (4 - hydroxy - m -anisyl)-, 2944.
C₁₅H₁₅O₂ Glutaric acid, β - phenyl-, di-Et ester, 494.
 Malonic acid, phenethyl-, di-Et ester, 471.
 Santonin acid, 126, 702.
 Santoninic acid, 126.
C₁₅H₁₅O₂ Guaiacol, 4 - (γ - hydroxybutyl)-, diacetate, 2943.
C₁₅H₁₅O₂ Isophthalic acid, 2,4,6 - trimethoxy-, di-Et ester, 646.
C₁₅H₁₅O₂ Androcin, 2672.
 Glucacetovanillone, 2672.
C₁₅H₁₅CuN₂O₇Se, 2173.
C₁₅H₁₅NO Acetophenone, α - cyclohexylmethylamino-, 511.
 Benzamide, N - (β - cyclohexylethyl)-, 825.
C₁₅H₁₅NO₂ Benzamide, N - [α - (4 - hydroxyisopropyl) - γ - methyl - Δ^1 - butenyl]-, 2809.
 Cyclohexanol, dimethylamino-, benzoate, -HCl, 2196.
 1 - Propanol, 3 - (1 - piperidyl)-, benzoate, and -HCl, 1424.
C₁₅H₁₅NO₂S Lactole, perhydro - 2 - methyl - 1 - (phenylsulfonyl)-, 1862.
C₁₅H₁₅NO₂ Quinoline, 1 - acetyl - 1,2,3,4 - tetrahydrodimethoxydimethyl-, 2344.
C₁₅H₁₅N₂O₄ Oximidocarbamic acid, Et isonaphylester, Br deriv., 976.
C₁₅H₁₅NO₂ Tyrosine, N - (carboxymethyl)-, di-Et ester, 6371.
C₁₅H₁₅N₂O₂ See *Physostigmine*.
C₁₅H₁₅N₂O₂ See *Geneserliche*.
C₁₅H₁₅N₂O₄ γ - Butenophenone, 3,4,5 - trimethoxy-, semicarbazone, 466.
C₁₅H₁₅N₂O₄ Conhydrinone, methyl-, oxime, picrate, 1280.
C₁₅H₁₅N₂ Pyrrole, 3,3' & methylenebis(2,4,5-trimethyl-, 2336.
C₁₅H₁₅N₂O₂S Urea, α - allyl - β - (4,5 - dimethoxy-2-propylphenyl)thio-, 2474.
C₁₅H₁₅N₂O₄ Carbamic acid, benzalbis-, di-Pr ester, 2478.
C₁₅H₁₅N₂N₂O Acanthine, 1004.
C₁₅H₁₅N₂O₇ Cyclohexylamine, 2 - isopropyl-, picrate, 1862.
 Piperidine, 1 - *sec* - butyl-, picrate, 288.
C₁₅H₁₅N₂O₂ Δ^1 - Cyclohexenone, 3 - methyl - 5-phenyl-, semicarbazide - semicarbazone, 3484.
C₁₅H₁₅O 3 - Nonanone, 1 - phenyl, 1899.
C₁₅H₁₅O₂ Propionic acid, 4 - phenethylbutyl ester, 2331.
C₁₅H₁₅O₂ 3 - Heptanone, 1 - (3,4 - dimethoxyphenyl)-, 2944.
 3 - Hexanone, 1 - (3,4 - dimethoxyphenyl)-5-methyl-, 2944.
 3 - Octanone, 1 - (4 - hydroxy - m - anisyl)-, 2944.
 3 - Pentanone, 1 - (3,4 - dimethoxyphenyl)-4,4-dimethyl-, 2944.
C₁₅H₁₅O₂ Isohumulinic acid, 1428.
C₁₅H₁₅O₂ Cyclohexanemalononic acid, hydroxyisopropylmethyl, lactone, Et ester, 2644.
C₁₅H₁₅O₂ 1,1,2,3 - Cyclopropanetetra-carboxylic acid, tetra Et ester, 210.
C₁₅H₁₅O₂ Arabonic acid, Et ester, tetraacetate, 817.
C₁₅H₁₅O₂ Lactic acid, tetralactyl, 3082.
C₁₅H₁₅N Piperidine, 1 - (α - ethylphenethyl)-, 288.
C₁₅H₁₅NO Benzamide, N - [α - (α - hydroxyisopropyl)isomyl]-, 2800.
 1 - Butanol, 3 - amino - 2,2 - diethyl-, benzoate, 816.
C₁₅H₁₅NO₂S Benzenesulfonamide, N - 2 - isopropylcyclohexyl-, 1862.
 —, N - 2 - propylcyclohexyl-, 1862.
C₁₅H₁₅NO Benzamide, N - [γ - hydroxy - α - (α - hydroxyisopropyl)isomyl]-, 2800.
 3 - Heptanone, 1 - (3,4 - dimethoxyphenyl)-oxime, 2944.
 3 - Hexanone, 1 - (3,4 - dimethoxyphenyl)-5-methyl-, oxime, 2944.
 3 - Pentanone, 1 - (3,4 - dimethoxyphenyl)-4,4 - dimethyl-, oxime, 2944.
C₁₅H₁₅NO Acetal, veratralamino-, 2955.
 Dinicotinic acid, 1,2 (and 1,4) - dihydro 1,2,4,6 - tetramethyl, di-Et ester, 2497.
 Humulinic acid, oxime, 1428.
C₁₅H₁₅N₂O Eserethol, nitroso-, 1426.
C₁₅H₁₅N₂O₂ Eserinol, 1426.
C₁₅H₁₅N Benzene, ethylheptyl-, 1222.
 Bisabolene, 2333.
 Cadalene, hexahydro-, 2333.
 Cadinene, 489.
 Cedrene, 2726.
 Combane, 2389.
 Compd., b. 140-1°, from hydrocarbon from lignite, 2736.
 Isocadinene, 489.
 Populene, 2 HCl m. 84-7°; 2 HBr m. 110-7°, 7051.
 Sesquiterpene from the cotton plant., b. 260-80°, 22271.

- $C_{11}H_{15}BrO_2$ Sapogenin from neutral saponin from *Polygala amara*, tetrabromo deriv., 489^a.
- $C_{11}H_{15}N_2O$ Lupanine, 1428^a; and salt, 3271^b.
- $C_{11}H_{15}N_2O_2$ Carbamic acid, (diethylaminoethyl)-, phenethyl ester, and -HCl, P 1757^a.
- 3 - Pyrrolecarboxylic acid, 2,5 - dimethyl-4 - (1 - piperidylmethyl)-, Et ester, -HClO₄, 2336^a.
- $C_{11}H_{15}N_2O_4$ Hydrazine, α - heptyl - β - phenyl-, oxalate, 3478^a.
- $C_{11}H_{15}O$ See Farnesol.
- $C_{11}H_{15}O_2$ Benzaldehyde, dibutyl and diisobutyl acetal, 1694^a.
- Campholic acid, 2 - methyl - 3 - butin - 2 - ol ester, 1417^a.
- Sapogenin from *Polygala amara*, Me ester, 489^a.
- $C_{11}H_{15}O_3$ 3 - Camphanepropionic acid, 2 - keto-, ethyl ester, 2818^a.
- $C_{11}H_{15}O_5$ 1,4 - Glucose, (1,2)(5,6) - diacetone-3-allyl-, 2035^a.
- $C_{11}H_{15}Br$ Compd., b.p. 185°, from hydrocarbon from lignite, 2736^a.
- $C_{11}H_{15}NO_2$ Acetal, veratrylamino-, 2955^a.
- $C_{11}H_{15}N_2O$ Semicarbazide, 1,2 - diisobutyl-4-phenyl-, 3478^a.
- $C_{11}H_{15}N_2S$ Semicarbazide, 1,2 - diisobutyl - 4-phenylthio-, 3478^a.
- $C_{11}H_{15}N_3$ Benzylethylpropylarsonium iodide, 1403^a.
- $C_{11}H_{15}N_3$ See Sparleine.
- $C_{11}H_{15}O$ Cadinol, 488^a.
- Cinnamonomol, 2388^a.
- Combamol, 2388^a.
- Compd., m. 196-200°, from oil from leaves of *Lantana camara*, 1177^a.
- Foliol, 2388^a.
- Machilol, 1704^a.
- $C_{11}H_{15}O_2$ Borneol, valerate, 2657^a.
- Campholic acid, 2 - methyl - Δ^3 - 2 - butenol ester, 1417^a.
- Cedrene glycol, 2726^a.
- Δ^1, α - Cyclohexanecarboxylic acid, 5 - isopropyl-, 2 - dimethyl-, Et ester, 2030^a.
- Fenchyl alcohol, valerate, 2657^a.
- Isoborneol, valerate, 2657^a.
- $C_{11}H_{15}O_2$ Butyrin, 1446^a, 2638^a.
- $C_{11}H_{15}NO_6$ Carbamic acid, diethylthiono-, bornyl ester, 57^a.
- $C_{11}H_{17}N_2O_2$ Malonic acid, acetonylisobutyl-, di-Et ester, semicarbazone, 3480^a.
- $C_{11}H_{17}$ Compd. from humulinic acid, 1428^a.
- $C_{11}H_{17}O_2$ Cadinene glycol, 488^a.
- Campholic acid, tert Am ester, 1417^a.
- $C_{11}H_{17}O_2$ Cyclohexanecarboxylic acid, α - hydroxy-, heptyl ester, 982^a.
- , β -hydroxy - 5 - isopropyl-, α - 2 - dimethyl-, Et ester, 2030^a.
- Machilol, dihydroxy 1704^a.
- $C_{11}H_{17}O_2$ Malonic acid, bis(β , β - diethoxyethyl)-, and Ba salt, 1129^a.
- $C_{11}H_{17}O_4$ Undecaoxymethylene, diacetate, 1245^a.
- $C_{11}H_{17}NO_2$ Malonic acid, (β - diethylaminoethyl)ethyl-, di-Et ester, 1560^a.
- $C_{11}H_{18}$ 4 - Tridecene, 2,4 - dimethyl-, 2475^a.
- $C_{11}H_{18}N_2O$ Cuscohygrine, dimethiodide, 1282^a.
- $C_{11}H_{20}O$ 2-Pentadecanone, 1692^a, 2807^a.
- Pentadecylaldehyde, 3251^a.
- $C_{11}H_{20}NO_3$ 3 - Nonanone, 7^a diethylamino-ethyl-, 2476^a.
- $C_{11}H_{21}N_2O$ Cuscohygrine, dihydro-, dimethiodide, 1282^a.
- $C_{11}H_{21}O$ 4 - Tridecanol, 2,4 - dimethyl-, 2475^a.
- $C_{11}H_{21}N_2$ Triethylamine, CH₃I addn. compd., 1403^a.
- $C_{11}H_{21}P_3$ Phosphine, triethyl-, CH₃I addn. compd., 1403^a.
- $C_{11}H_{21}N_2O_2$ Dehydroindigo, 5,6,7,8,6',7'-hexa-iodo-, KHSO₅ compd., 1422^a.
- $C_{11}H_{21}Cl_2N_2O_2$ Indigotin, 4,4' - dichloro-5,7,5',7' - tetraiodo-, and NaHSO₅ compd., 1422^a.
- $C_{11}H_{21}N_2O_2$ Dehydroindigo, 5,7,5',7' - tetraiodo-, NaHSO₅ compd., 1421^a.
- $C_{11}H_{21}N_2O_2$ Indigotin, 5,6,7,5',6',7' - hexa-iodo-, 1422^a.
- $C_{11}H_{21}Br_2N_2O_2$ Indigotin, tetrabromo-, 1199^a.
- $C_{11}H_{21}Cl_2N_2O_2$ Dehydroindigo, 4,4' - dichloro-, and derivs., 1422^a.
- $C_{11}H_{21}N_2O_2$ Dehydroindigo, 6,6' - diiodo-, and NaHSO₅ compd., 1422^a.
- $C_{11}H_{21}N_2O_2$ Indigotin, 5,7,5',7' - tetraiodo-, 1421^a.
- $C_{11}H_7ClO_2$ Anthracoumarin, 6 - chloro-, 3269^a.
- $C_{11}H_7Cl_2N_2O_2$ 2 - Anthraldehyde, 5,6,7,8 - tetrachloro - 9,10 - dihydro - 9,10 - diketone, semicarbazone, 2045^a.
- $C_{11}H_7N_2O_2S$ Oxindole [Δ^3 1'] - 2(1) - thionaphtheneone, 5,7 - diiodo-, 1422^a.
- $C_{11}H_7ClN_2O_2$ 4,5 - α , β - Naphthotriazoledione, 2 - (p - chlorophenyl-), 1865^a.
- $C_{11}H_7HgN_2O_2$ Pseudoisatin, 1,1' - mercuribis-, 2051^a.
- $C_{11}H_{12}N_2O_2$ Indigotin, 5,5' - diiodo-, 506^a.
- $C_{11}H_{12}N_2O_2$ 2,1 - Indenoidene - 5,10 - dione, 4,9 - dihydro - 2,7 - dinitro-, 2198^a.
- $C_{11}H_7O_2S$ Thioindigo, 733^a.
- $C_{11}H_7O_2S$ Thioindigo, S - monoxide, 504^a.
- $C_{11}H_7O_2$ Oxindigo, 2046^a.
- $C_{11}H_7O_2S_2$ Thioindigo, S-dioxide, 504^a.
- $C_{11}H_7BrO_2$ 1,3 - Indandione, 2 - (p - bromosalicylal)-, 2948^a.
- $C_{11}H_7ClN_2O_2$ 1,4 - Naphthoquinone, 2 - chlor-3 - N - nitrosoanilino-, 2821^a.
- $C_{11}H_7ClO_2$ 2 - Anthraquinonecarboxyl chloride, 4,5 - dihydroxy - 7 - methoxy-, 1860^a.
- $C_{11}H_7NO_2S$ 2(1) - Thionaphtheneone, 1 - [2-keto - 3(2) - indylidene]-, 2951^a.
- $C_{11}H_7NO_4$ 1,3 - Indandione, 2 - (nitrobenzal)-, 2947^a.
- $C_{11}H_7N_2O_2$ Naphthotriazoledione, phenyl-, 1864^a, 2821^a.
- $C_{11}H_{10}$ Pyrene, 2334^a.
- $C_{11}H_{10}AsClO$ α - Benzophenoyarsine, 7 - chloro-, 2038^a.
- $C_{11}H_{10}BrNO_2$ 2(1) - Benzofuranone, 4 - bromo-5 - methoxy - 1 - o - nitrobenzal-, 2047^a.
- $C_{11}H_{10}BrN_2$ α , β - Naphthotriazole, 2 - (p - bromophenyl)-, 1865^a, 2496^a.
- $C_{11}H_{10}BrNO_2$ α , β - Naphthotriazole, 2 - (p - bromophenyl)-, oxide, 2496^a.
- 5 - α - Naphthotriazolol, 2 - (p - bromophenyl)-, 2496^a.
- $C_{11}H_{10}BrN_2O_4$ 1,2,3 - Triazole - 3 - o - benzoic acid, 1 - (p - bromophenyl) - 4 - carboxy-, mono-Na salt, 1865^a.
- Triazolylphenyl - O - dicarboxylic acid, 2, N - p - bromophenyl-, 2496^a.
- $C_{11}H_{10}Br_2Cl_2O_2$ 1,4 - Butanedione, 2,3 - di-bromo - 1,4 - bis(p - chlorophenyl)-, 1268^a.
- $C_{11}H_{10}Br_2N_2O_4$ Benzoic acid, 4,4' - azobis[2-bromo-, ester with glycol, 2332^a.
- $C_{11}H_{10}Br_2N_2S_4$ 1,3 - Thiodiazole, 2,2' - dithio-bis[5 - (p - bromophenyl)imino] - 4,5 - dihydro-, 488^a.

- $C_{10}H_{10}Br_2O_2$ Δ^1 - 1,4 - Butenedione, 1,4 - bis(*p*-bromophenyl) -, 1369¹.
 — 2,3 - dibromo - 1,4 - diphenyl-, 1268².
 $C_{10}H_{10}Br_2O_2$ 1,4 - Butanedione, 2,2,3,3 - tetrabromo - 1,4 - diphenyl-, 1268².
 $C_{10}H_{10}ClF_2$ α, β - Naphthotriazole, 2 - (*p* - chlorophenyl) -, 2496⁷.
 $C_{10}H_{10}ClN_2O_2$ 1,2 - δ - Indenotriazole - 8 - Carboxylic acid, 2,2' - (*p* - chlorophenyl) - 2,8 - dihydro - 8 - hydroxy-, and *Na* salt, 2205⁴.
 Pyrazole, chloro - 1 - *o* - nitrobenzoylphenyl-, 2953³.
 $C_{10}H_{10}ClN_2O_2$ 1,2,5 - Triazole - 3 - *o* - benzoic acid, 4 - carboxy - 1 - (*p* - chlorophenyl) -, and *mono-Na* salt, 1865⁷.
 Triazolephenyl - *O* - dicarboxylic acid, 2, *N* - *p* - chlorophenyl-, 2496⁷.
 $C_{10}H_{10}ClN_2O_2$ Benzene, chlorotrinetro-, naphthalene addn. compd., 254¹.
 Picryl chloride, $C_{10}H_5$ addn. compd., 254¹.
 $C_{10}H_{10}Cl_2N_2S$ 1,3,4 - Thiodiazole, 2,2' - dithio-bis[5 - (*m* - chlorophenylimino) - 4,5 - dihydro-, 958⁹.
 $C_{10}H_{10}Cl_2O$ Furan, 3,4 - dichloro - 2,5 - diphenyl-, 1268².
 $C_{10}H_{10}Cl_2O_2$ 9 - Anthrol, 1,5 - dichloro-, 2489².
 Δ^1 - 1,4 - Butenedione, 2,3 - dichloro - 1,4 - diphenyl-, 1268².
 $C_{10}H_{10}Cl_2O_2$ Anthrone, 1,5 - dichloro - 10 - hydroxy-, acetate, 2489².
 $C_{10}H_{10}INO_2$ Cinchophen, 6-iodo-, 506².
 $C_{10}H_{10}N_2$ 7,8 - *f* - Quinoquinoline, and *sulfate*, 2956⁴.
 $C_{10}H_{10}N_2O$ 9 - α - Benzophenazolinol, 643⁴.
 $C_{10}H_{10}N_2O_2$ (See also *Indigotin*.)
 9,10 - α - Benzophenazinediol, 1283¹.
 Indin, 2336².
 Isoindigotin, 2204⁴, 2336².
 $C_{10}H_{10}N_2O_2$ 1,2,3,6 - Dioxiazine, 4,5 - dibenzoyl-, 469².
 Isatoid, 2050⁷.
 $C_{10}H_{10}N_2O_2S$ Indindisulfonic acid, salts, 2204⁷.
 $C_{10}H_{10}N_2S$ α, α' - Stilbenediol, dithiocyanate, 2235⁵.
 $C_{10}H_{10}N_2O_2$ 2,1,3 - Benzotriazole, 2 - (3,4-diketone - 1 - naphthyl) -, 3 - oxime, *Zn* salt, 515².
 $C_{10}H_{10}N_2O_2$ 1,2,3,4 - Butanetetrone, tetraoxime, diperoxide, 2187².
 $C_{10}H_{10}N_2O_2$ 2(1) - Pyrazinone, 3,6 - bis(*o* - nitrophenyl) -, 2239².
 $C_{10}H_{10}O_2$ 2,1 - Indenoidene - 5,10 - dione, 4,9 - dihydro-, 2198².
 $C_{10}H_{10}O_2$ α, α' - Benzildicarboxylic acid, 2198².
 $C_{10}H_{10}O_2$ 2 - Anthraquinonecarboxylic acid, 4,5 - dihydroxy - 7 - methoxy-, 1880².
 $C_{10}H_{10}BrO_2$ Δ^1 - 194 - Butenedione, δ - bromo - 1,4 - diphenyl-, 1268².
 $C_{10}H_{10}ClN_2O$ Pyrazole, 1 - benzoyl - chlorophenyl-, 2953³.
 $C_{10}H_{10}ClN_2O_2$ Benzene, chlorodinitro-, naphthalene addn. compd., 254¹.
 $C_{10}H_{10}ClO_2$ Δ^1 - 1,4 - Butenedione, 2 - chloro - 1,4-diphenyl-, 1268².
 $C_{10}H_{10}ClO_2$ Benzoyl chloride, hydroxy-, acetoxybenzoate, 1417².
 $C_{10}H_{10}F_2O_2$ Anthraquinone, ethylfluoro-, 2950².
 $C_{10}H_{10}IN_2O_2$ Quinaldine, 6 - iodo-, picrate, 506².
 $C_{10}H_{10}KO_2$ 1,3 - Isodandione, 2 - α - hydroxybenzyl-, *K* deriv., 2496⁷.
 $C_{10}H_{10}KO_2$ Flavone, 2,6,3',4' - tetrahydroxy-7-methoxy-, *K* deriv., 3270⁴.
- $C_{10}H_{10}NO$ 2(1) - Naphthalenone, 1 - phenylimino-, 2487², 2662⁷.
 $C_{10}H_{10}NO_2$ (See also *Cinchophen*.)
 Cinchoninic acid, *Ph* ester, 2954².
 $C_{10}H_{10}NO_2$ Cinchophen, 3-hydroxy-, 1573².
 $C_{10}H_{10}NO_2$ Phthalimide, *N* - (*p* - hydroxyphenyl) -, acetate, 272².
 $C_{10}H_{10}N_2O_2$ 2 - Anthraquinonecarboxamide, 4,5-dihydroxy - 7 - methoxy-, 1860².
 $C_{10}H_{10}N_2$ α, β - Naphthotriazole, 2 - phenyl-, 2954².
 $C_{10}H_{10}N_2O$ 2,1,3 - Benzotriazole, 2 - (4 - hydroxy - 1 - naphthyl) -, 515².
 $C_{10}H_{10}N_2O_2$ 4,5 - α, β - Naphthotriazediol, 2-phenyl-, 1865¹.
 Succinonitrile, α - (*m* - nitrophenyl) - β - phenyl-, 2198².
 $C_{10}H_{10}N_2O_2S$ Thiazole, 2 - (*p* - nitrobenzalamino) - 4-phenyl-, 512².
 $C_{10}H_{10}N_2O_2$ Indenotriazole, 8 - carboxylic acid, 2,8 - dihydro - 8 - hydroxy - 2 - phenyl-, and *Na* salt, 2205⁴, 2954².
 1 - Naphthol, 4 - (*o* - nitrophenylazo) -, 515².
 1,4 - Naphthoquinone, 2 - amino - 3 - *N* - nitrosoanilino-, 2824².
 $C_{10}H_{10}N_2O_2$ Benzoic acid, 3 - nitro - 4 - (8-quinolylamino) -, 1280¹.
 1,2,5 - Triazole - 3 - benzoic acid, 4 - carboxy - 1 - phenyl-, 2954²; and salts, 1865⁷.
 $C_{10}H_{10}N_2O_2$ Triazolephenyl - *O* - dicarboxylic acid, 2, *N* - phenyloxy-, 2496⁷.
 $C_{10}H_{10}NaO_2S$ 1 - Naphthalenesulfonic acid, 8 - (2,4 - dinitroankino) -, and *Na* salt, 2462².
 $C_{10}H_{10}$ Phenanthrene, 1-vinyl-, 2500².
 $C_{10}H_{10}AsCl_3$ Arsine, chlorobis(β - chlorostyryl) -, 2329².
 $C_{10}H_{10}AsNO_2$ Cinchoninic acid, 2 - (*p* - arsonophenyl) -, and *di-Na* salt, 1255².
 $C_{10}H_{10}BrN_2$ 2 - Naphthylamine, 1 - (*p* - bromophenylazo) -, 2496⁷.
 $C_{10}H_{10}BrN_2O$ Imidazole, 5 - bromo - 1 - methyl-4-phenyl-, picrate, 1706².
 $C_{10}H_{10}ClNO$ 1 - Naphthol, 4 - (*p* - chloroanilino) -, 2493².
 $C_{10}H_{10}ClN_2$ 2 - Naphthylamine, 1 - (*p* - chlorophenylazo) -, 2496⁷.
 $C_{10}H_{10}ClN_2O$ 5 - Pyrazolone, 1 - (chlorophenyl) - 4 - (*o* - chlorophenylazo) - 3 - methyl, 507², 508¹.
 —, 1 - (2,4 - dichlorophenyl) - 3 - methyl-4 - phenylazo-, 508².
 $C_{10}H_{10}Cl_2O$ Ether, 1,5 - dichloro - 9 - anthryl ethyl, 2490².
 $C_{10}H_{10}Cl_2O_2$ Anthrone, 1,5 - dichloro - 10 - ethoxy-, 2490².
 1,4 - Butanedione, 2,3 - dichloro - 1,4 - diphenyl-, 1268².
 $C_{10}H_{10}HgN_2O_2S$ Benzenesulfonic acid, [hydroxy-(hydroxymercuri)naphthylazo] -, *Hg* salt, 2482².
 $C_{10}H_{10}HgN_2O_2S$ Benzenesulfonic acid, [hydroxybis(hydroxymercuri)naphthylazo] -, 2482².
 $C_{10}H_{10}N_2O$ β -F,4,8-Anthrisoquinoxaline, 2-methyl-, 3270⁴.
 1,2 - β - Benzofuroquinoxaline, 6,8 - dimethyl-, 3046⁷.
 $C_{10}H_{10}N_2O_2$ Imidazole, 3 - benzoyl-, acetyl deriv., 505².
 2,1 - Indenoidene - 5,10 - dione, 2,7 - diamino - 4,9 - dihydro, and *HCl*, 2198².
 1,4 - Naphthoquinone, 2 - amino - 3 - amino-, 2820².

- $C_{16}H_{12}N_2O_2$ 3, 3' - Bioxindole, 3, 3' - dimer-capto-, 1862⁷.
- $C_{16}H_{12}N_2O_2$ Anthraquinone, 1 (and 2) - β - (acetylhydrazino)-, 1274⁸.
- 3, 3' - Bioxindole, 3 - hydroxy-, 2336⁹.
- Hydrindin, 2336⁹.
- Oxindole, 3 - (6-aminopiperonylidene)-, and picrate, 2956⁴.
- $C_{16}H_{12}N_2O_4$ Isatide, 2204⁸.
- $C_{16}H_{12}N_2O_8$ Benzenesulfonamide, *N* - naphthyl - *m* - nitro-, 642¹.
- $C_{16}H_{12}N_2O_8$ Diamond black PV, 219⁹.
- $C_{16}H_{12}N_2O_8$ Glycol, bis(*p* - nitrobenzoate), 3262².
- $C_{16}H_{12}N_2S_2$ Hydrobenzoin, dithiocyanate, 2334⁹.
- $C_{16}H_{12}N_4$ 2, 1, 3 - Benzotriazole, 2 - (4 - aminonaphthyl)-, 515⁴.
- α , β - Naphthotriazole, 2 - (*p* - aminophenyl)-, 2205⁴.
- $C_{16}H_{12}N_2O_2$ Furazap, 3, 4 - bis(phenylimino-methyl)-, 2-oxide, 2808³.
- 1 - Naphthylamine, 4 - (o - nitrophenylazo)-, 515².
- $C_{16}H_{12}N_4O_2$ 1, 2, 5 - Triazole - 3 - *o* - benzoic acid, 4 - carbamyl - 1 - phenyl - (?), *NH*₄ salt, 1865⁹.
- 1, 2, 5 - Triazole - 3 - carboxylic acid, 4 - (o-carbamylphenyl) - 1 - phenyl-(?), *NH*₄ salt, 1865⁹.
- $C_{16}H_{12}N_2O_8$ Thiazole, 2 - methyl - 5 - phenyl-, picrate, 1706⁷.
- $C_{16}H_{12}N_4$ 1, 2, 3 - Triazole, 1, 1' - *p* - biphenylene-bis-, 476³.
- $C_{16}H_{12}O$ Indone, 2 - methyl - 3 - phenyl-, 2208⁷.
- $C_{16}H_{12}O_2$ Anthraquinone, 1, 3 - dimethyl-, 499⁸.
- Δ^1 - 1, 4 - Butenedione, 1, 4 - diphenyl-, *SnCl*₄ addn. compd., 50⁹.
- $C_{16}H_{12}O_2$ Acrylophenone, β - hydroxy-, benzoate, 2049⁴.
- 5 - Benzofuranol, 2 - methyl-, benzoate, 2665⁴.
- Δ^1 - 1, 4 - Butenedione, 2 - hydroxy - 1, 4 - diphenyl-, 1268⁸.
- Chalcone, 3, 4 - methylenedioxy-, 306¹⁸.
- 1, 3 - Indandione, 2 - α - hydroxybenzyl-, 3486⁴.
- $C_{16}H_{12}O_4$ Cinnamic acid, 3, 4 - methylenedioxy- α - phenyl-, and Ag salt, 2486¹.
- 2, 5 - Cresotic acid, lactide, 521¹.
- Flavone, 7 - hydroxy - 3 - methoxy-, 517⁴.
- Maleic acid, diphenyl-, 1704¹.
- 9 - Phenanthrenecarboxylic acid, 9, 10 - dihydroxy - 2, 3 (or 3, 4) - methylenedioxy-, 499⁸.
- $C_{16}H_{12}O_4$ Anthraquinone, 1, 8 - dihydroxy - 3 - methoxy - 6 - methyl -, 2046³.
- Flavone, 5, 7 - dihydroxy - 3 - methoxy-, 1141¹.
- $C_{16}H_{12}O_4$ Anthraquinone, 1, 4, 5, 8 - tetrahydroxy-2, 6-dimethyl-, 276⁷.
- $C_{16}H_{12}O_7$ Dermocybin, 2822⁴.
- Flavone, 3, 5, 3', 4' - tetrahydroxy - 7 - methoxy-, 3270⁹.
- $C_{16}H_{12}O_8$ Δ^1 - 1, 4 - Butenedione, 1, 4 - bis(trihydroxyphenyl)-, 983¹.
- $C_{16}H_{12}O_{10}$ Compd. from $CrCl_3$ and EtOH, 40⁸.
- $C_{16}H_{12}BrO_2$ Chalcone, α - bromo - β - methoxy-, 43¹.
- $C_{16}H_{12}BrO_4$ Ferulic acid, 5 - bromo - α - phenyl-, 2485⁴.
- $C_{16}H_{12}BrO_4$ Meconin, 2 - (5 - bromosalicyl)-, 500⁴.
- $C_{16}H_{12}ClN_2$ Pyrazole, 1 - benzylchlorophenyl-, 2953².
- $C_{16}H_{12}ClN_2O_2$ 3 - Isophenoxazone, 4 - acetamido-, 9 - chloro - 2, 10 - dimethyl-, 234⁹.
- $C_{16}H_{12}ClO_4$ Benzoic acid, *o* - (3 - chloro - 4-ethylbenzoyl)-, 2950⁸.
- 5, 7 - Dihydroxy - 4 - methyl - 2 - phenylbenzopyrylium chloride, *FeCl*₃ compd., 1707⁴.
- $C_{16}H_{12}ClO_4$ Cresotic acid, (chloroformyl)tolyl ester, 521¹.
- 5, 7 - Dihydroxy - 3 - methoxy - 2 - phenylbenzopyrylium chloride, 2342⁹.
- p* - Toluic acid, α - chloro-, *p* - carboxybenzyl ester, 2815⁷.
- $C_{16}H_{12}ClO_4$ 5, 7 - Dihydroxy - 3 - methoxy - 2-phenylbenzopyrylium perchlorate, 2342⁹.
- $C_{16}H_{12}Cl_2NO$ Anthrone, 1, 5 - dichloro - 10 - dimethylamino-, 2490⁷.
- $C_{16}H_{12}Cl_2NO_2S$ Aniline, dichloro-, naphthalenesulfonate, 650⁹.
- $C_{16}H_{12}Cl_3O_2$ Acetic acid, trichloro-, benzylbenzoate addn. compd., 3252⁴.
- $C_{16}H_{12}FO_2$ Benzoic acid, *o* - (4 - ethyl - 3 - fluoro-benzoyl)-, 2950⁸.
- $C_{16}H_{12}KO_2$ Chalcone, 2 - hydroxy - 3 - methoxy-, K salt, 982⁴.
- $C_{16}H_{12}N$ Naphthylamine, *N* - phenyl-, 2200¹.
- α - Tolunitrile, α - cinnamal-, 1416².
- $C_{16}H_{12}NO$ Compd., m. 193-4⁹, from acetophenone and oxindole, 499⁴.
- Naphthol, anilino-, 2493³, 2662⁷.
- Quinoline, 2 - *p* - anisyl-, and salts, 1268⁸.
- α - Tolunitrile, α - phenacyl-, 2822⁴.
- $C_{16}H_{12}NO_2$ Benzofuranone, 3, 5 - dimethylphenylimino-, 2046³.
- Δ^1 - 1, 4 - Butenedione, 2 - amino - 1, 4 - diphenyl-, 1268⁸.
- 2 - Indolecarboxylic acid, 1 - benzyl-, 2204⁴.
- $C_{16}H_{12}NO_2$ Hippuric acid, α - benzal-, 2040⁸.
- 1 - Indaone, 2 - hydroxy-, carbanilate, 66².
- 5 - Oxazolidone, 3 - benzoyl - 2 - phenyl-, 2639⁷.
- Oxindole, 3 - piperonyl-, 499².
- $C_{16}H_{12}NO_4$ Chalcone, 4' - methoxynitro-, 1266¹, 1268¹².
- 3 - Isophenoxaz - 3 - one, 9 - hydroxy - 4, 8 - dimethyl-, acetate, 2649⁴.
- $C_{16}H_{12}NO_5$ Naphthalenesulfonic acid, anilino-hydroxy-, and salts, 2662⁷.
- $C_{16}H_{12}NO_5$ Benzamide, hydroxy-, acetoxybenzoate, 1417².
- p* - Toluic acid, α - anisal - 3 - nitro-, salts, 1419⁷.
- , α - *o* - methoxybenzal - 3 - nitro-, salts, 1419⁷.
- $C_{16}H_{12}NO_5$ Succinic acid, α - (*m* - nitrophenyl)- β -phenyl-, 2198³.
- $C_{16}H_{12}NO_7$ Phthalide, 5, 6 - dimethoxy - 2 - (5-nitrosalicyl)-, 2490⁷.
- $C_{16}H_{12}N_2$ 2 - Naphthylamine, 1 - phenylazo-, 2496⁷.
- Pyrrrole, phenylphenylazo-, 2203¹.
- $C_{16}H_{12}N_2O_2$ Urea, β - phenyl - β - 8 - quinolyl-, 1280¹.
- $C_{16}H_{12}N_2OS$ 1, 4, 3 - Isothiodiazine, 2 - benzamido-5-phenyl-, 831⁹.
- $C_{16}H_{12}N_4O_2$ Indoloquinoxaline, 2, 9 - dimethoxy-, and salts, 2956⁹.
- 9 - Phenanthrenecarboxylic azide, 9, 10 - phenyl - 1 - phenyl-, acetyl deriv., Tolunitrile, α - anilino - *m* - nitro-, acetyl

- C₁₂H₁₂N₂O₄ 1 - Acridanglycine, 5 - keto - *N*-nitroso-, Me ester, 294².
- C₁₂H₁₂N₂O₄ *o* - Toluidine, *N* - acetyl - *α* - benzal, 6 - dinitro-, 4914.
- C₁₂H₁₂N₂O₅ 1 - Naphthalenesulfonic acid, 8 - (2-aminophenyl-4-nitroanilino)-, and Na salt, 2662².
- C₁₂H₁₂N₂O₅ Stilbene, 3', 4' - dimethoxy - 2, 4, 6 - trinitro-, 2955².
- C₁₂H₁₂N₂O₅ 1, 2, 5 - Triazole - 3 - *o* - benzamide, 4-carbamyl-1-phenyl-, 1865².
- C₁₂H₁₂N₂O₅ *α* - Nicotyrine, picrate, 74².
- Pyrazole, 1 - methyl - 5 - phenyl-, picrate, 2049².
- Pyridine, isopicrate, 1700².
- C₁₂H₁₂AgNO₄ Dicresotamide, Ag deriv., 51², 521².
- C₁₂H₁₂AsClO₄ Benzoic acid, *o*, *o'* - chloroarsylenebis-, di-Me ester, 480².
- C₁₂H₁₂CrNO₃ Anilic, bromo-, naphthalene-sulfonate, 650².
- C₁₂H₁₂Br₂O₂ *p* - Diamine, 2, 5 - dibromo - 2, 5-diphenyl-, 2206².
- Bromophenone, *α*, *β* - dibromo - *α* - methoxy-, *β*-phenyl-, 1419².
- C₁₂H₁₂ClNO₃ Compd., m. 159-60°, from 5'-chloro - 6' - hydroxy - *m* - benzotoluide and AcCl, 1562².
- C₁₂H₁₂ClNO₃ Aniline, chloro-, naphthalene-sulfonate, 650².
- C₁₂H₁₂ClNO₃ Tyrosine, chloro-, Bz deriv., 2817².
- C₁₂H₁₂N₄ Azetodiamine, 5i, 10a, 10b, 11 - tetrahydro-, 65².
- 1, 2 - Naphthylenediamine, *N*² - phenyl-, 1283².
- Quinaldine, 4 - anilino-, -HCl, 1279².
- C₁₂H₁₂N₂O₃ Cinnamaldehyde, benzoylhydrazone, 2953².
- Pyrazinoic acid - 1(2) - one, 3, 7 - dihydro-3-methyl-, 2961².
- C₁₂H₁₂N₂O₃ Benzothiazole, 1 - (*p* - acetamidophenyl) - 5 - methyl-, 1411².
- C₁₂H₁₂N₂O₃ Benzothiazole, 5 - dimethylamino-1-*ε*-mercapto-, benzoyl deriv., 513².
- C₁₂H₁₂N₂O₂ Carbazole, 1 - acetamido - 9 - acetyl-, 282².
- 2 - Quinoxalinol, 3 - (6 - hydroxy - 2, 4-xylyl)-, 2046².
- C₁₂H₁₂N₂O₂ 1 - Acridanglycine, 5 - keto-, Me ester, 294².
- 9 - Phenanthrenecarboxylic acid, 9, 10 - dihydro - 2, 3(or 3, 4) - methylenedioxy-, hydrazide, 499².
- C₁₂H₁₂N₂O₂ Hydroquinol, 2 - phenylazo-, diacetate, 44².
- 2 - Propanone, 1 - (*o* - *p*-phenenyl)-, benzoate of oxime, 2938².
- p* - Toluic acid, *α* - (*p* - aminobenzal) - 3-nitro-, Me ester, 1420².
- C₁₂H₁₂N₂O₂ Hydroquinol, 2 - phenylazoxy-, diacetate, 44².
- C₁₂H₁₂N₂O₂ Aniline, nitro-, naphthalenesulfonate, 650².
- C₁₂H₁₂N₂O₂ Stilbene, dimethoxydinitro-, 1420¹, 2955².
- C₁₂H₁₂N₂S 1, 2, 4 - Thiodiazole, 3, 5 - di - *p*-tolyl-, 3087².
- C₁₂H₁₂N₂O 9 - Phenanthrenecarboxylic azide, 9, 10 - dihydro - 2, 3(or 3, 4) - methylenedioxy-, 499².
- C₁₂H₁₂N₂O 2, 3' - Bis[1, 4 - imidazopyridin-2-yl]-, 8, 8' - dimethyl - (?) , 1276².
- C₁₂H₁₂N₂O Indole, 1, 3 - dimethyl-, picrate, 511².
- 2 - Naphthylamine, *or* - dihydro-, picrate, 497².
- C₁₂H₁₂N₂O₁ Serine, benzoate, picrate, 638².
- C₁₂H₁₂N₂S 1, 4, 3 - Isothiodiazine, 5 - phenylthiocarbamido-, 832².
- C₁₂H₁₂O₂ 1(2) - Benzofuranone, 2, 4 - dimethyl-2-phenyl-, 1276².
- , 2-ethyl-2-phenyl-, 1277².
- Chalcone, *α*-methoxy-, 1419².
- 9 - Phenanthrenecarboxylic acid, 9, 10-dihydro - 10 - methyl-, 499².
- C₁₂H₁₂O₂ 1(2) - Benzofuranone, 2 - anisyl - 4-methyl-, 2044².
- Benzoic acid, *o* - (*o*-toluyl)-, Me ester, 1262².
- Chalcone, hydroxymethoxy-, 982², 1571²; and -HCl, 1414².
- 9 - Phenanthrenecarboxylic acid, 9, 10-dihydro-3-methoxy-, 499².
- 1, 2 - Propanedione, *p* - anisylphenyl-, 1419².
- Propiophenone, *β* - anisyl - *α*, *β* - epoxy-, 283².
- C₁₂H₁₂O₂ Ethanol, 2 - (benzoylmercapto)-, benzoate, 1557².
- C₁₂H₁₂O₂ Benzoic acid, *ε* - (*o* - ethoxybenzoyl)-, 2489².
- 2, 4 - Cresotic acid, Ph ester, acetate, 51².
- Ferulic acid, *α*-phenyl-, 2485².
- Malonic acid, (*η* - phenyl - Δ^{2,4,4} - heptatrienylidene)-, 2941².
- Succinic acid, *α*, *β* - diphenyl-, 1704², 2198²; Na salt, 2155².
- C₁₂H₁₂O₂ Benzoic anhydride, dimethoxy-, 429².
- Cresotic acid, cresotate, 51², 521².
- Propiophenone, 2, 4 - dihydroxy - *β* - (3, 4-methylenedioxyphenyl)-, 2652².
- C₁₂H₁₂O₂ Glycol, disalicylate, 3262².
- Hematoxylin, 623².
- C₁₂H₁₂Br Ethylene, 2 - bromo - 1, 1 - di - *p*-tolyl-, 491².
- C₁₂H₁₂BrN₂O Oxazolidine, 2 - (*p* - bromophenylimino)-3-*p*-tolyl-, 2481².
- C₁₂H₁₂BrN₂O Glyoxylic acid, *β* - bromophenyl-, 2, 4 - xylylhydrazone, 1853².
- C₁₂H₁₂BrN₂S Thiazolidine, 2 - (*p* - bromophenylimino) - 3 - *p* - tolyl-, 2484².
- , 3 - (*p* - bromophenyl) - 2 - *β* - tolylimino-, 2481².
- C₁₂H₁₂ClO₂ Chroman, 3 - chloro - 4 - methoxy-4-phenyl-, 284².
- 2 - Propanone, 1 - *o* - anisyl - 3 - chloro - 1 - phenyl-, 286².
- C₁₂H₁₂IN₂ Pyrazole, diphenyl-, methiodide, 6049².
- C₁₂H₁₂N₂ Δ² - Pyrrolide, 2, 4 - diphenyl-, 2k22².
- C₁₂H₁₂NO Dihydro deriv., m. 130°, of compd. from acetophenone and oxindole, 499².
- Nitron, *α* - styryl - *N* - *p* - tolyl-, 1258².
- C₁₂H₁₂NO₂ Chalcone, amino - 4' - methoxy-, 1268²; and salt, 1269².
- Cinnamic alc., phenylurethan, 2659².
- Ethylene, 2 - nitro - 1, 1 - di - *p*-tolyl-, 491².
- α* - Isodurylic acid, *α*⁴ - phenylimino-, 483².
- Δ² - Isoxazoline, 5 - anisal - 3 - phenyl-, 1415².
- Oxindole, 3 - (*p* - methoxybenzyl)-, 499².
- Phthalaldehydanilide, 3, 5 - dimethyl-, 483².
- C₁₂H₁₂NO₂ Acetanilide, 2 - hydroxy - 5 - phenyl-, acetate, 1869².
- Alapine, *N* - benzoyl - *β* - phenyl-, 2040².
- , *β* - phenyl - *N* - salicylal, Ba salt, 2630².
- p* - Benzotoluide, hydroxy-, acetate, 1417².
- Dibenzamide, methoxymethyl-, 1416², 1417².

- Glyoxylanilide, (6 - hydroxy - 2,4 - xylyl)-, 2046^o.
- l - Tyrosine, *N* - benzal-, *N* salt, 243^o.
- C₁₁H₁₁N₂O₂S Aniline, naphthalenesulfonate, 650^o.
- Naphthylamine, benzenesulfonate, 651^o.
- C₁₁H₁₁N₂O₂ Benzyl alcohol, α - ethyl-, *p* - nitrobenzoate, 2324^o.
- Carbamic acid, ethylhydroxy-, Ph ester, benzoate, 3258^o.
- Cresotic acid, carbamyltolyl ester, 51^o, 52^o.
- Dibenzamide, *o*,*o'* - dimethoxy-, 1410^o.
- Dicrosotamide, 51^o, 52^o.
- Tyrosine, benzoyl-, 126^o.
- C₁₁H₁₁N₂O₂ Dibenzamide, *p*,*p'* - dihydroxy-, diacetate, 1417^o.
- C₁₁H₁₁N₂O₂S Benzotriazole, 5 - dimethylamino - 2 - imino-, benzoyl deriv., 513^o.
- C₁₁H₁₁N₂O₂S 1 - Naphthalenesulfonic acid, 8-(2,4 - diaminoanilino)-, and derivs., 2662^o.
- C₁₁H₁₁N₂O₂ Acetamide, *N*,*N* - bis(nitrobenzyl)-, 3261^o.
- C₁₁H₁₁N₂O₂ Indazole, 2 - ethyl - 5 - methyl-, picrate, 511^o.
- Isindazole, 2 - ethyl - 5 - methyl-, picrate, 511^o.
- C₁₁H₁₁ Ethylene, *as* - di - *p* - tolyl-, 491^o.
- Propene, 2 - methyl - 1,3 - diphenyl-, 1138^o.
- C₁₁H₁₁AsBrO₂ 6 - Carboxymethyl - 6 - ethylphenoxarsonium bromide, 2038^o.
- C₁₁H₁₁AsN₂O₂ *p* - Toluic acid, 3,3' - arsenobis[5-amino-, 479^o.
- C₁₁H₁₁ClNO₂ 3,6 - Dimethoxy - 10 - methylacridinium chloride, P 3567^o.
- C₁₁H₁₁ClN₂O Glyoxylanilide, - chloro-, xylylhydrazone, 43^o.
- C₁₁H₁₁ClN₂O₂ Pyruvyl chloride, 3 - nitro - *p*-tolylhydrazone, phenylhydrazone, 3090^o.
- C₁₁H₁₁MoO₂ Molybdo - dimandelic acid, 1545^o.
- C₁₁H₁₁N₂O₂ Thiazolidine, 2 - (*o* - anisylimino)-3-phenyl-, 2481^o.
- , 3 - *o* - anisyl - 2 - phenylimino-, 2481^o.
- C₁₁H₁₁N₂O₂ Anisaldehyde, azine, derivs., 2648^o.
- Benzoic acid *p* - (*p* - dimethylaminobenzal-amino)-, 1416^o.
- Carbamic acid, (9 - carbazylmethyl)-, Et ester, 292^o.
- Glycnitrile, *N*, α - di - *p* - anisyl-, 637^o.
- Glyoxylic acid, phenyl-, 2,4 - xylylhydrazone, 1852^o.
- 3 - Isophenoxazone, 4 - amino - 2,2,7,10-tetramethyl-, 2340^o.
- 9 - Phenanthrenecarboxylic acid, 9,10-dihydro - 3 - methoxy-, hydrazide, 490^o.
- Δ^1 - 4 - Pyrazolinol, 5 - anisyl - 3 - phenyl-, 283^o.
- Pyruvic acid, phenyl-, *p* - tolylhydrazone, 3261^o.
- Terephthalaldehyde acid, 3,5 - dimethyl-, phenylhydrazone, 483^o.
- C₁₁H₁₁N₂O₂ Anthranilic acid, *N* - (*o* - acetamidophenyl) - *N* - methyl-, and Ag salt, 987^o.
- Succinamic acid, *N* - [*p* - (*p* - aminophenyl)-phenyl]-, 2190^o.
- C₁₁H₁₁N₂O₂S Phenylhydrazine, naphthalenesulfonate, 650^o.
- C₁₁H₁₁N₂O₂ Toluidine, *N* - (nitro - *o* - veratral)-, 483^o.
- , α - (2,3 - dimethoxybenzal) - 5 - nitro-, 2955^o.
- C₁₁H₁₁N₂O₂S Disulfoxide, bis(*p* - acetamidophenyl), 475^o.
- C₁₁H₁₁N₂O₂ 3,4 - Pyrroledicarboxylic acid, 1 - (*p* - acetamidophenyl) - 2,5 - dimethyl-, 278^o.
- C₁₁H₁₁N₂S Benzothiazole, 1 - [(and 6) - amino - *m* - tolyl] - 3,5 - dimethyl-, 112^o.
- Thiazolidine, 2 - (benzylimino) - 3 - phenyl-, 2481^o.
- , 3 - benzyl - 2 - phenylimino-, 2481^o.
- , 2 - phenylimino - 3 - *p* - tolyl-, 2481^o.
- , 3 - phenyl - 2 - *p* - tolylimino-, 2481^o.
- p* - Toluimdic acid, *N* - (*p* - methylbenzimidio)thio-, and -HCl, 3087^o.
- C₁₁H₁₁N₂O₂ 2,1,3 - Benzotriazole, 2 - (5 - acetamido - 2 - phenetyl)-, 514^o.
- o* - Glyoxylotoluid, tolylazo-, oxime, 2646^o.
- C₁₁H₁₁N₂O₂ 1,2 - Propanedione, 1 - (*o* - nitrophenyl)-, 1 - oxime, 2 - methylphenylhydrazone, 2938^o.
- 1,4 - Pyrrolopyridazinedione, 6 - (*p* - acetamidophenyl) - 2,3 - dihydro - 5,7 - dimethyl-, 279^o.
- C₁₁H₁₁N₂O₂ Valeraldehyde, α - 2 - fural-, 2,4-dinitrophenylhydrazone, 1139^o.
- C₁₁H₁₁N₂O₂ 2 - Naphthylamine, *ar* - tetrahydro-picrate, 497^o.
- Picrate, m. 164^o, of compd. from 5 - ethyl-2-vinylpyridine and MeI, 1573^o.
- C₁₁H₁₁N₂O₂ Isoquinoline, 1,2,3,4 - tetrahydro-6-methoxy-, picrate, 990^o.
- 2 - Naphthol, 7 - aminotetrahydro-, picrate 497^o.
- 2 - Propanone, 1 - (*N* - methylanilino)-picrate, 511^o.
- C₁₁H₁₁O Butanone, diphenyl-, 1269^o, 3486^o.
- 1,2-Butene oxide, 3486^o.
- p* - Cresol, 2 - phenylallyl-, 1566^o, 2038^o.
- Ether, γ - phenylallyl *p*-tolyl-, 2038^o.
- C₁₁H₁₁O₂ Benzyl alcohol, α - ethyl-, benzoate 2636^o.
- Bianisal, 1265^o.
- Chroman, 4 - methoxy - 4 - phenyl-, 286^o.
- p* - Dioxane, 2,5 - diphenyl-, 220^o.
- 1 - Propanol, 1,3 - diphenyl-, formate, 2331^o.
- Propionic acid, α - phenyl - α - *p* - tolyl-645^o.
- Veratrole, 4-styryl-, 2485^o.
- C₁₁H₁₁O₂S Ethanol, 2 - (benzylmercapto)-benzoate, 1557^o.
- C₁₁H₁₁O₂ 3 - Chromanol, 4 - methoxy - 4 - phenyl-286^o.
- Propionic acid, α - benzohydroxy-, 1567^o.
- C₁₁H₁₁O₂ Mandelic acid, α - benzyl - *p* - methoxy-1419^o.
- , α - *p* - methoxybenzyl-, 1419^o.
- Mangostin, 827^o.
- C₁₁H₁₁O₂S Ethanol, 2 - (benzylsulfonyl)-, benzoate, 1557^o.
- C₁₁H₁₁O₂ Acrylophenone, β - 2 - furyl - 2,4,5-trimethoxy-, 823^o.
- o* - Veratric acid, 6 - (*o* - hydroxybenzyl)-300^o.
- C₁₁H₁₁O₂ Coumarin, 5,7 - dihydroxy - 3 - methoxy-, bismethoxyacetate, 654^o.
- C₁₁H₁₁AsN₂O₂ Arsanilic acid, *N* - (*p* - carbethoxyaminobenzoyl)-, 979^o.
- C₁₁H₁₁Br Propene, 2 - bromo - 2 - methyl - 1,1-diphenyl-, 1138^o.
- C₁₁H₁₁BrN₂O₂ Carbanilide, bromo - α - (β - hydroxyethyl)methylthio-, 2481^o.
- C₁₁H₁₁BrN₂O₂ Resorcinol, α - (5 - bromo - 1-carvacrylato)-, 641^o.
- C₁₁H₁₁Cl Methane, α - chloroxylyl)tolyl-2485^o.
- C₁₁H₁₁ClN₂O₂ *p* - Quinonimine, γ - amino - *N*

- (3 - chloro - 6 - hydroxy - 2,4 - xylol)-
3,5 - dimethyl-, 2339³.
- C₁₀H₁₇IN₂ Benzylidimethyl 2 - isindazolium
iodide, 512^{1,2}.
- C₁₀H₁₇N₂ Aniline, *N*, *N* - dimethyl - *p* - styryl-,
2485³.
Indanamine, *N*-tolyl-, 1520³.
Isoquinoline, 1 - benzyl - 1,2,3,4 - tetra-
hydro-, *and* -HCl, 2055¹.
Pyrridine, 2,4 - diphenyl-, *and* -HCl,
2822³.
- C₁₀H₁₇NO Acetamide, *N*, *N* - dibenzyl-, 3261³.
—, *N* - (β,β - diphenylethyl)-, 2822³.
- C₁₀H₁₇NO₂ Acetanilide, *o* - β - phenylethoxy-,
1423³.
o - Cresol, 6 - ethyl-, carbanilate, 270³.
Nitron, α - *p* - anisyl - *N* - 2,5 - xylol-,
1259¹.
Propiophenone, β - *p* - anisyl-, oxime, 982³.
—, *p* - methoxy - β - phenyl-, oxime, 982³.
- C₁₀H₁₇NO₂ Carbanilic acid, β - (methoxyphenoxy)ethyl ester, 1421⁴.
- C₁₀H₁₇NO₂ Nicotinic acid, 5 - acetyl - 4 - furyl-,
1,6 - dihydro - 6 - keto - 1,2 - dimethyl-,
Et ester, 2497².
- C₁₀H₁₇N₂O Acetophenone, 4 - *p* - tolylsemicarba-
zone, 478³.
2 - Propanone, 1,1 - diphenyl-, semicarba-
zone, 3486¹.
- C₁₀H₁₇N₂O₂ Acetophenone, 3,5 - dimethyl-,
p - tropenylhydrazone, 1408¹.
- C₁₀H₁₇N₂O₂ 1,2,4 - Naphthalenetriamine, *N*¹,
*N*², *N*⁴ - trigecetyl-, 2201³.
- C₁₀H₁₇N₂O₂ Anisaldehyde, 2 - ethoxy - 5 - nitro-,
phenylhydrazone, 1701³.
- C₁₀H₁₇N₂O₂ Thymoquinonedimine, monopic-
rate, 981³.
- C₁₀H₁₇ Propane, 2 - methyl - 1,3 - diphenyl-,
1138³.
- C₁₀H₁₇AsI Allylmethyldiphenylarsonium io-
dide, 1403³.
- C₁₀H₁₇AsIO 6,6 - Diethylphenoxarsonium io-
dide, 2038³.
- C₁₀H₁₇As₂F₂O₄ *p* - Arsenophenol, 3,3' - bis
(glycidamino)-, *di* -HCl, 2646³.
- C₁₀H₁₇BrN₂O₂ *p* - Toluene-sulfonanilide, *N* -
(β - bromo - α - methoxyethyl)-, 283¹.
- C₁₀H₁₇ClBrN₂O₂ See *Novasurol*.
- C₁₀H₁₇ClN₂O₂ See *Methylethyl blue*.
- C₁₀H₁₇HgS₂ Phenyl mercaptan, *o* - ethyl-, Hg
salt, 1412³.
- C₁₀H₁₇IN Phenethylamine, *N* - benzal-, methio-
dide, *and* *aurat*es, 990⁴.
- C₁₀H₁₇I₂N₂O₄ *o* - Toluidine, 4 - iodo-, oxalate,
2192³.
- C₁₀H₁₇N₂O Camphoceanic acid, 3 - (2 - benzi-
midazolyl)-, cyclic amide, 2494¹.
Camphonic acid, 3 - (β - benzimidazolyl)-,
cyclic amide, 2494¹.
Hydrazine, α - isopropyl - β - phenyl-, *Bz*
deriv., 642³.
Ketone, 1 - ethyl - 2 - pyrrolidyl 4 - quino-
lyl-, 657¹.
—, 1 - methyl - 2 - piperidyl 4 - quinolyl, 656³.
α - Toluamide, *o* - amino - *N* - phenethyl-,
2580³.
Valeraldehyde, α - 2 - fural-, phenylhydra-
zone, 1139¹.
- C₁₀H₁₇N₂O₂ Carbanilide, α - (β - hydroxyethyl)-
methylthio-, 2481³.
- Urea, benzyl (β - hydroxyethyl)phenylthio-,
2481⁴.
- C₁₀H₁₇N₂O₂ Acetamide, α - amino - *N* - (β -
hydroxy - β,β - diphenylethyl)-, 636³.
- Anisaldehyde, 2 - ethoxy-, phenylhydrazone,
1701³.
- Ketone, 6 - methoxy - 4 - quinolyl 1 - methyl-
2 - pyrrolidyl, 657¹.
- C₁₀H₁₇N₂O₂ Carbanilide, α - (β - hydroxyethyl)-
methoxythio-, 2481³.
- C₁₀H₁₇N₂O₂ Bilirubin, 102³.
Phenctole, azoxybis-, 1646⁴.
- C₁₀H₁₇N₂O₂ Dicresotamide, NH₄ salt, 51³, 521⁴.
- C₁₀H₁₇N₂O₂S Benzenesulfonanilide, *N* - butyl-
m-nitro-, 642³.
- C₁₀H₁₇N₂O₂ 1 - Hydantoinacetic acid, 5 - anisal-
3 - methyl-, *Et* ester, 636³.
- C₁₀H₁₇N₂O₂ Addn. compd. of pyrocatechol
and piperazinedione, 585³.
Addn. compd. of resorcinol and piperazine-
dione, 585³.
- C₁₀H₁₇N₂O₂ Addn. compd. of piperazinedione
and pyrogallol, 585³.
- C₁₀H₁₇N₂S Carbanilide, thirteenth-, 2481³.
- C₁₀H₁₇N₂O₂ Aniline, *N*, *N*' - (2,3 - butylene)-
bis[*N* - nitroso-, *and* sulfate, 2936⁴.
- C₁₀H₁₇N₂O₂ Histidine, *N* - (N - carboxytyro-
sine)-, 1248³.
- C₁₀H₁₇N₂O₂ Aniline, *N*, *N*' - diethyl-, picrate,
510³.
- C₁₀H₁₇N₂O₂ Ethanol, β,β' - phenyliminobis-,
picrate, 2038¹.
- C₁₀H₁₇N₂S Burea, dithio - β,β' - di - *o* - tolyl-,
2495¹.
- C₁₀H₁₇N₂O₂ Pyruvamide, 3 - nitro - *p* - tolylhy-
drazone, phenylhydrazone, 3090³.
- C₁₀H₁₇N₂O₂ 2,3 - Butanediamine, dipicrate,
984³.
- C₁₀H₁₇O 2 - Propanol, 2 - methyl - 1,3 - diphenyl-,
1138³.
- C₁₀H₁₇OS₂ Ether, bis(β - phenylmercaptoethyl),
1413³.
- C₁₀H₁₇O₂ Benzyl alcohol, α - (α - methoxy-
phenethyl)-, 1419³.
Hydrobenzoin, α - ethyl-, 491³.
- C₁₀H₁₇O₂ Ether, bis(β - phenoxyethyl), 1413³.
- C₁₀H₁₇O₂ 1,2 - Naphthalenedicarboxylic acid,
3,4 - dihydro-, *di* - *Et* ester, 1269⁴.
- C₁₀H₁₇O₂ Caproic acid, α - (3,4 - methylenedi-
oxycinnamyl)-, 470³.
Oxalacetic acid, styryl-, *di* - *Et* ester, 1269⁴.
- C₁₀H₁₇PbS₂ Phenyl mercaptan, *o* - ethyl-, Pb
salt, 1412³.
- C₁₀H₁₇BrN₂O Ketone, α - bromo - *e* - methyl-
aminoamyl 4 - quinolyl, *and* *di* -HBr,
656³.
- C₁₀H₁₇ClN₂ Acetamidine, *N* - methyl - *N*, *N*' -
diphenyl-, methochloride, 1279³.
- C₁₀H₁₇ClO Phenanthrene, 9 - chloroacetyl-,
1,2,3,4,5,6,7,8 - octahydro-, 1274¹.
- C₁₀H₁₇IN₂ Acetamidine, *N* - methyl - *N*, *N*' -
diphenyl-, methiodide, *and* chlorophos-
phate, 1279³.
- C₁₀H₁₇NO 2 - Propanol, 2 - (aminomethyl)-
1,1-diphenyl-, 636³.
- C₁₀H₁₇NO₂ Camphonic acid, 3 - cyano-, Ph
ester, 2656³.
- C₁₀H₁₇NO₂ Benzyl alcohol, α - anilino - 3,4,5-
trimethoxy-, *and* -HCl, 2651⁴.
- C₁₀H₁₇N₂O Semicarbazide, 2 - isopropyl - 1,4-
diphenyl-, 642³.
- C₁₀H₁₇N₂O₂ Cyclohexanecetic acid, α,1 - di-
cyano-, aniline salt, 268³.
- C₁₀H₁₇N₂S Semicarbazide, 2 - isopropyl - 1,4-
diphenylthio-, 642³.
- C₁₀H₁₇AsBr Diethyldiphenylarsonium bromide,
1403⁴.

- $C_{12}H_{25}AsI_3$ Diethyldiphenylarsonium triiodide, 1403².
- $C_{12}H_{25}BrN$ Benzohydriltrimethylarmonium bromide, 1567⁴.
- $C_{12}H_{25}Cl_2N_2$ Bihydrazine, β, β' - bis(β - chloroethyl) - β, β' - diphenyl-, 283⁴.
- $C_{12}H_{25}NO_3S$ 1 - Propanesulfonic acid, 1 - phenylcarbamyl-, aniline salt, 37⁴.
- $C_{12}H_{25}N_2$ Aniline, N, N_4 - (2,3 - butylene)bis-, and salts, 2030⁴.
- Benzidine, tetramethyl-, P 1710⁷.
- $C_{12}H_{25}N_2O$ Aniline, β, β' - oxybis[N - ethyl-, 1413⁵.
- Camphananilide, 3 - cyano-, 1410¹.
- 4 - Quinolincarbinol, α - (1 - methyl - 2 - piperidyl)-, 656⁹.
- $C_{12}H_{25}N_2O_2$ 4,4' - Bi - m - phenetidine, 820⁴.
- Camphoceanic acid, 3 - (2 - benzimidazolyl)-, 2493².
- Camphonic acid, 3 - (2 - benzimidazolyl)-, 2493².
- Ketone, ϵ - aminoamyl 6 - methoxy - 4 - quinolyl, 656⁹.
- Phenecole, m, m' - hydrazobis-, 820⁴.
- $C_{12}H_{25}N_2O_2$ Δ^2 - 1,2 - Butenedicarboxylic acid, 3 - phenylazo-, di-Et ester, 2326⁴.
- $C_{12}H_{25}N_2O_2S$ p - Toluenesulfonamide, N, N' - ethylenebis-, 67².
- $C_{12}H_{25}N_2O_2$ 1 - Hydantoinacetic acid, 5 - p - methoxybenzyl - 3 - methyl-, Et ester, 636².
- $C_{12}H_{25}O$ Butyrophenone, α, α - diallyl-, 1134².
- $C_{12}H_{25}O_2$ Compd., m. 239.43° (decompn.), from dicyclopentadiene and quinone, 2499⁴.
- $C_{12}H_{25}O_4$ Caproic acid, α - (p - methoxycinnamyl)-, 460⁴.
- $C_{12}H_{25}O_2$ Oxalacetic acid, phenethyl-, di-Et ester, 1269³.
- $C_{12}H_{25}BrO_{11}$ d -Glucose, tetraacetyl- α -bromoacetyl-, 20347.
- $C_{12}H_{25}FO_{11}$ d -Glucose, tetraacetyl- α -fluoroacetyl-, 20347.
- $C_{12}H_{25}NO_2$ See *Homatropine*.
- $C_{12}H_{25}NO_4$ Homatropine, N -oxide, and -HBr, 2670⁴.
- Malonic acid, p - dimethylaminobenzal-, di-Et ester, 1415².
- $C_{12}H_{25}NO_3S$ Homatropine, N - sulfonated ether, 2670⁴.
- $C_{12}H_{25}N_2O$ Cyclohexenone, ethylmethyl-, phenyl-semicarbazone, 3485².
- $C_{12}H_{25}$ 2 - Pentene, 3,3' - p - phenylenebis-, 490⁴.
- $C_{12}H_{25}MoN_2O_2$ Ammonium molybdo-dimandelate, 1536⁹.
- $C_{12}H_{25}N_4$ 3,9 - Pyridindole, 1,2,3,4 - tetrahydro - 1,2,3,4,9 - pentamethyl-, 5077.
- $C_{12}H_{25}N_2O$ Isoquinoline, decahydro - 2 - phenylcarbamyl-, 825².
- $C_{12}H_{25}N_2O_2$ Malonic acid, acetonil-, di-Et ester, phenylhydrazone, 3480⁴.
- $C_{12}H_{25}N_4$ Biindazole, 4,5,6,7,4',5',6',7' - octahydro - 7,7' - dimethyl-, 1263².
- $C_{12}H_{25}N_2$ Indazole, 3,3' - azobis[4,5,6,7 - tetrahydro-7-methyl-, 1263².
- $C_{12}H_{25}O_2$ 3 - Bornylenecarboxylic acid, 2 - methyl-3 - butin - 2 - ol ester, 1418¹.
- $C_{12}H_{25}O_2$ Pelargonaldehyde, θ - hydroxy-, benzoate, 468⁴.
- $C_{12}H_{25}O_2$ Phthalic acid, di-Bu ester, P 3491¹.
- Santoninic acid, Me ester, 126⁴.
- $C_{12}H_{25}O_2$ Humulolquinone, 1428⁴.
- $C_{12}H_{25}O_2$ + 2H₂O See *Coniferin*.
- $C_{12}H_{25}IN_2O_2$ Methiodide, m. 198-9°, of oxidation product from eserethole, 1140⁴.
- $C_{12}H_{25}N$ Propene, 2,2' - (diethylamino - p - phenylenebis)-, 490⁴.
- $C_{12}H_{25}NO_2$ Addn. compd. of hydroquinone and diethylamine, 258².
- Cyclohexanepropanol, carbanilate, 2040⁴.
- $C_{12}H_{25}NO_4$ Dinicotinic acid, 4 - ethyl - 1,2-dihydro - 1,6 - dimethyl - 2 - methylene-, di-Et ester, and perchlorate, 2497¹.
- Nicotinic acid, 5 - acetyl - 1,6 - dihydro - 4-isobutyl - 6 - keto - 1,2 - dimethyl-, Et ester, 2497².
- $C_{12}H_{25}AsNO_3$ Carbanilic acid, 5 - arsono - 2 - (carboxyoxo)-, di-Bu and diisobutyl esters, 979⁴.
- $C_{12}H_{25}BrN_2O$ Compd., m. 122°, from lupanine and BrCN, 1426⁴.
- $C_{12}H_{25}N_2O$ η - Octenylamine, γ, η - dimethyl- N - nitroso - N - phenyl-, 2029⁴.
- $C_{12}H_{25}N_2O_2$ Carbamic acid, (ethylpiperidylethyl)-, phenyl ester, and -HCl, P 1757⁹.
- $C_{12}H_{25}N_2O_3$ Oxeseretholmethine, amine oxide, and -HCl, 2500⁴.
- $C_{12}H_{25}N_2O_3$ Carbamic acid, carboxy(diethylaminoethyl)-, ethylphenyl ester, P 1757⁹.
- $C_{12}H_{25}N_2O_3S$ Oxeseretholmethine, amine oxide, ester, 2500⁴.
- $C_{12}H_{25}O_2$ 3 - Bornylenecarboxylic acid, 2 - methyl - Δ^3 - 2 - butenol ester, 1418¹.
- 3 - Camphanecarboxylic acid, 2 - methyl-3 - butin - 2 - ol ester, 1418².
- Caprylophenone, p - methoxy-, 267¹.
- $C_{12}H_{25}O_2$ 3 - Octanone, 1 - (3,4 - dimethoxyphenyl)-, 2944².
- $C_{12}H_{25}AsN_2O_7$ o - Benzenedicarbamic acid, 4 - arsono-, di-Bu and diisobutyl esters, 979⁴.
- $C_{12}H_{25}N$ η - Octenylamine, γ, η - dimethyl- N - phenyl-, and salts, 2029⁴.
- $C_{12}H_{25}NO_2S$ Benzenesulfonamide, N - 2 - isobutylcyclohexyl-, 1832².
- $C_{12}H_{25}NO_3$ 3 - Octanone, 1 - (3,4 - dimethoxyphenyl)-, oxime, 2944².
- $C_{12}H_{25}N_2O_3$ 3 - Hexanone, 1 - (3,4 - dimethoxyphenyl) - 5 - methyl-, semicarbazone, 2944¹.
- 3 - Pentanone, 1 - (3,4 - dimethoxyphenyl) 4,4 - dimethyl-, semicarbazone, 2944².
- $C_{12}H_{25}$ 1,15 - Hexadecadiene, 633⁴, 1850⁷.
- $C_{12}H_{25}CuO_4$ 3,5 - Heptanedione, 4 - methyl-, Cu deriv., 1558⁴, 2027².
- $C_{12}H_{25}IN$ Cyclohexyldimethyl(α - Methylbenzyl)ammonium iodide, 2828⁴.
- Cyclohexyldimethylphenethylammonium iodide, 2828⁴.
- $C_{12}H_{25}N_2$ Hydrazine, α - (3,7 - dimethyl - Δ^1 - octenyl) - α - phenyl-, 2029⁴.
- $C_{12}H_{25}N_2O$ Hydroeseretholmethine, $ZnCl_2$ salt, 1427¹.
- Lupanine, methyl-, chloroaurate, 3271⁴.
- $C_{12}H_{25}N_2O_2$ 2 - Incipol, 3 - (γ - dimethylaminopropyl) - 6 - methoxy - 2,3 - dihydro - 1 - methyl-, and salts, 1140⁴, 1427^{1,2}.
- Quinone, 2,5 - bis(2-methylamino)-, 259¹.
- $C_{12}H_{25}O$ Anisole, p -nonyl-, 267¹.
- $C_{12}H_{25}O_2$ 3 - Bornylenecarboxylic acid, *tert*-Am ester, 1418¹.
- 3 - Camphanecarboxylic acid, 2 - methyl- Δ^3 - 2 - butenol ester, 1418².
- Campholic acid, β - methyl - 1 - pentin - 3 - ol ester, 1417².
- $C_{12}H_{25}AsI_4$ Benzyl-diethyldipropylarsonium iodide, CHI_3 addn. compd., 1403².

- C₁₆H₂₇ClN₂O₂ See *Alypine*.
 C₁₆H₂₇N₂O Lupanine, methylide, 3271^a.
 C₁₆H₂₇N Aniline, *N, N* - dimethyl-, 475^a.
 C₁₆H₂₇N₂O Butyraldehyde, β - *p* - phenetidino-, di-Et acetal, 2343^a.
 C₁₆H₂₇BrO₂ 4 - Propanone, 1 - (ethylmethylamino)-, δ - π - α - bromocamphorsulfonate, 511^a.
 C₁₆H₂₇Br₂ 1, 15 - Hexadecadiene, 2, 15 - dibromo-, 633^a.
 C₁₆H₂₇Br₂N₂O Piperazine, 1, 4 - bis(α - bromoisocaproyl)-, 2830^a.
 C₁₆H₂₇N₂O Piperazine, 1 - (β - aminoethyl)-4 - [β - amino - γ - (*p* - hydroxyphenyl)-propyl] - 2 - methyl-, 801^a.
 C₁₆H₂₇O₂ 3 - Camphanecarboxylic acid, *tert*-Am ester, 1418^a.
 Campholic acid, 3 - methyl - Δ^1 - 3 - pentenol ester, 1417^a.
 Camphyl alcohol, caproate, 2657^a.
 Hydnocarpic acid, 356^a, 2476^a.
 C₁₆H₂₇O₂ Mentholglucuronic acid, 867, 3457.
 C₁₆H₂₇O₂ Dihexosan, tetramethyl-, 304^a.
 C₁₆H₂₇NO₂ Leucine, *N* - campholyl-, 2052^a.
 C₁₆H₂₇O₂ Campholic acid, 3 - methyl - 3 - pentanol ester, 1418^a.
 θ - Hexadecenoic acid, 2186^a.
 Hydnocarpic acid, dihydro-, 2476^a.
 Palmitoleic acid, 2186^a.
 C₁₆H₂₇O₂ Caprylic anhydride, 3081^a.
 Cyclohexanecarboxylic acid, α - hydroxy-, octyl ester, 982^a.
 Palmitic acid, γ - keto-, 1128^a.
 C₁₆H₂₇O₂ Dodecaoxymethylene, diacetate, 1245^a.
 C₁₆H₂₇NO₂ Glycine, *N* - lauryl-, Et ester, 2051^a.
 Palmitic acid, γ - keto-, oxime, 1128^a.
 C₁₆H₂₇ Cetene, 917^a.
 Hexadecene, 885^a, 966^a, 1695^a.
 C₁₆H₂₇N₂O Oxamide, *N, N'* - bis(methylhexyl)-, 4641^a.
 C₁₆H₂₇N₂O Piperazine, 1, 4 - dileucyl-, and di-*HBr*, 2830^a.
 C₁₆H₂₇O₂ 2 - Hexadecanone, 2807^a.
 Palmitaldehyde, 3261^a.
 C₁₆H₂₇C₂ See *Palmitic acid*.
 C₁₆H₂₇N₂S Pentadecylaldehyde, thiosemicarbazone, 5251^a.
 C₁₆H₂₇ See *Hexadecane*.
 C₁₆H₂₇N₂O 3 - Nonanone, 7 - diethylamino - 7 - ethyl-, semicarbazone, 2476^a.
 C₁₆H₂₇O Cetyl alcohol, 2635^a, 3396^a.
 Ether, bis(α - methylheptyl), 815^a.
 C₁₆H₂₇O₂ 5, 6 - Dodecanediol, 5 - butyl-, 352^a.
 C₁₆H₂₇O₂STl₂ Dibutylthallate sulfate, 3439^a.
 C₁₆H₂₇Cl₂MnN₂, 1385^a.
 C₁₆H₂₇Co₂N₂O₂Se, 617^a.
 C₁₆H₂₇BrNO₂S Compd. from isatin and β - bromo-2 - (carboxymethylmercapto)anilic acid, 2339^a.
 C₁₆H₂₇N₂O₂ 3 - *peri* - Benzophthalazine - 3, 7 (and 9) (2) 6 - dione, 2 - phenyl-, 2753^a.
 C₁₆H₂₇N₂O₂S Oxindole [Δ^3, Δ^7]rhodanine, 3'-phenyl-, 1422^a.
 C₁₆H₂₇O₂ 7 - Acenaphthenone, 8 - (2 - fural)-, 821^a.
 C₁₆H₂₇O₂ Resorcinolpyromucic acid, 2197^a.
 C₁₆H₂₇O₂S 2 - Anthraquinonecarboxylic acid, 3 - (carboxymethylmercapto)-, 1499^a.
 C₁₆H₂₇Ag₂Br₂O₂ Compd. from the Me ether of isatin, 2051^a.
 C₁₆H₂₇Br₂NO Naphthylamine, *N* - (3, 5 - dibromosalicylal)-, 259^a.
 C₁₆H₂₇Br₂O₂ Compd., m. 100-10^a, from acid^a from the marking nut, 3607^a.
 C₁₆H₂₇Cl₂O₂ 1, 4 - Naphthoquinone, 2 - chloro-3 - (*N* - nitrosoquinone)-, 2821^a.
 C₁₆H₂₇Cl₂O₂ 1, 4 - Naphthoquinone, 2 - chloro-3 - (β - methoxy - *N* - nitrosoanilino)-, 2821^a.
 C₁₆H₂₇ClO₂ Flavone, 2' - chloro - 3 - hydroxy-, acetate, 1863^a.
 Umbelliferone, 4 - methyl-, *o* - chlorobenzoate, 619^a.
 C₁₆H₂₇NO₂ 2 - Naphthol, nitrobenzoate, 260^a.
 C₁₆H₂₇NO₂ See *Hexophan*.
 C₁₆H₂₇NO₂ 2 - Anthroic acid, 9 - hydroxy - 10 - nitro-, acetate, 5011^a.
 Umbelliferone, 4 - methyl-, *m* - add-*p* - nitrobenzoate, 619^a.
 C₁₆H₂₇N₂Na Methane, 3 - indyl - 3 - pseudoindylidene-, *N*-Na deriv., 3488^a.
 C₁₆H₂₇N₂O₂ 4, 9 - $\beta\beta$ - Naphthothiazolodione, 1 - *p*-tolyl-, 2821^a.
 C₁₆H₂₇N₂O₂S Hydanthoin [Δ^3, Δ^7]oxindole, 3-phenyl-2-thio-, 507^a.
 Hydanthoin [Δ^3, Δ^7]pseudoindoxyl, 3 - phenyl-2-thio-, 507^a.
 C₁₆H₂₇N₂O₂ Hydanthoin [Δ^3, Δ^7]oxindole, 3-phenyl-, 507^a.
 C₁₆H₂₇N₂O₂ 1, 2, 5 - Triazole - 1 - *p*, 3 - *o* - di benzoic acid, and *mono-Na salt*, 1865^a.
 C₁₆H₂₇N₂O₂ 3, 9 - Pyridindole, picrate, 507^a.
 C₁₆H₂₇ClN₂O₂ 5 - Pyrazolone, 4 - benzal - 1 (2, 4 - dichlorophenyl) - 3 - methyl-, 508^a.
 C₁₆H₂₇ClO₂ Δ^1 - 1, 4 - Butenedione, 1, 4 - bis(*p*-chlorophenyl) - 2 - methoxy-, 1268^a.
 C₁₆H₂₇N₂ Methane, 3 - indyl - 3 - pseudoindylidene-, perchlorate, 3488^a.
 Pseudoindole, 3 - (3 - indylmethylene)-, salts, 829^a.
 C₁₆H₂₇N₂O₂ Indirubin, 7-methyl-, 1706^a.
 Isodioxoloquinindoline, 5 - methyl-, 2956^a.
 Isoindigotin, 7-methyl-, 1706^a.
 C₁₆H₂₇N₂O₂S Isoindigotin disulfonic acid, 7-methyl-, salts, 1706^a.
 C₁₆H₂₇O₂ 1, 4 - Pyrone, 2, 6 - diphenyl - 4 - thio-, 515^a.
 C₁₆H₂₇O₂ 9 - α - Benzoxanthene, 1568^a.
 1, 3 - Indandione, 2 - (methylbenzal)-, 2947^a.
 C₁₆H₂₇O₂ 1, 3 - Indandione, 2 - anisal-, 2948^a.
 C₁₆H₂₇O₂ 2 - Anthroic acid, 9 - hydroxy-, acetate, 5011^a.
 Coumarin, 7 - hydroxy - 3 - phenyl-, acetate, 824^a.
 Umbelliferone, 4 - methyl-, benzoate, 620^a.
 C₁₆H₂₇O₂S 2 - Anthracenecarboxylic acid, 3 - carboxy - α - mercapto-, 1710^a.
 C₁₆H₂₇O₂ Anthraquinone, 1 - hydroxy - 2 - methoxy-, acetate, 3270^a.
 C₁₆H₂₇O₂ Emodic acid, Et ester, 1861^a.
 C₁₆H₂₇Br₂N₂S Urea, α - (β - bromophenyl) - β - (1 - naphthyl) - thio-, 2481^a.
 C₁₆H₂₇BrO₂ Anthraquinone, 8 - bromo - 5 - hydroxy - 1, 2 - dimethoxy - 6 - methyl-, 500^a.
 C₁₆H₂₇Cl₂N₂O 5 - Pyrazolone, 4 - benzal - 1 - (chlorophenyl)-3 - methyl-, 507^a, 508^a.
 C₁₆H₂₇N₂ Quinaldine, α - benzal-, salts, 1267^a.
 C₁₆H₂₇NO Carbostyryl, 4-styryl-, 1278^a.
 2(1) - Naphthalenone, 1 - *p* - tolylimino-, 2662^a.
 Quinolol, 2 - styryl-, and salts, 1278^a, 1279^a.
 C₁₆H₂₇NO₂ Carbostyryl, 4 - (*o* - hydroxystyryl)-, 1278^a.

- 2(1) - Naphthalenone, 1 - (o - anisylimino)-, 2487^a.
 1,4 - Pyrone, 2,6 - diphenyl-, oxime, 516^a.
 Quinolinol, 2 - (o - hydroxystyryl)-, 1278^a, 1279¹.
 C₁₇H₁₃NO₄ 1,2 - Benzopyran - 3 - carboxy - *p*-toluide, 1416¹.
 Δ^{4,4} - 1 - Pentadienone, 5 - (nitrophenyl)-1-phenyl-, 1266^a, 1268^a.
 C₁₇H₁₃NO₄ Cinchophen, 3 - hydroxy - 4' - methoxy-, 1573⁷.
 C₁₇H₁₃NO₄ 1 - Anthroic acid, dihydrohydroxy-nitro-, acetate, 500^a.
 C₁₇H₁₃N₃ αβ - Naphthotriazole, 2 - tolyl-, 2496^a.
 C₁₇H₁₃N₃ Compd., m. 233°, from o - nitro-α - phenylcinnamionitrile, KCN and NH₄Cl, 2198^a.
 αβ - Naphthotriazole, 2 - tolyl-, oxide, 2496^a.
 5 - αβ - Naphthotriazolol, 2 - *p* - tolyl-(?), 2496^a.
 5(4) - Pyrazolone, 3 - (3 - indyl) - 1 - phenyl-, 279^a.
 C₁₇H₁₃N₃O₂ 1 - Naphthaldehyde, *p* - nitrophenylhydrazone, 3261^a.
 C₁₇H₁₃N₃O₂ Acetapilide, *p* - (4 - cyano - 2 - nitrostyryl)-, 1420^a.
 2 - Naphthol, 6 - methyl - 1 - (*p* - nitrophenylazo)-, 2819^a.
 C₁₇H₁₃N₃O₄ Naphthylamine, *N* - (dinitro - *m*-tolyl)-, 475¹.
 1,2,5 - Triazole - 3 - o - benzoic acid, 4-carboxy - 1 - phenyl-, mono-Me ester, 1865^a.
 Triazolyphenyl - Oα - dicarboxylic acid, 2, *N*-*p*-tolyl-, 2496^a.
 C₁₇H₁₃AsNO₄ Canchoninic acid, 2 - (*p* - arsonophenyl)-, Me ester, 1255^a.
 —, 2 - (*p* - arsonophenyl) - 6 - methyl-, 1256¹.
 C₁₇H₁₃BNO₄ Dipyrrocatecholboric acid, pyridine salt, 2178^a.
 C₁₇H₁₃BNO₄ Dipyrrogallolboric acid, pyridine salt, 2178^a.
 C₁₇H₁₃BiNO₄ 2310^a.
 C₁₇H₁₃Br₂O₂ Phthalide, 2 - (3,5 - dibromo - 2,6-cresyl) - 5,6 - dimethoxy-, 2490^a.
 C₁₇H₁₃ClNO 1 - Naphthylamine, *N* - (*p* - chlorophenyl) - 4 - methoxy-, 2493^a.
 C₁₇H₁₃Cl₂O₂ 3 - Chloro - 8 - ethoxy - 2 - phenylbenzopyrylium chloride, FeCl₃ compd., 1707^a.
 C₁₇H₁₃N₂ Indole, 3,3' - methylenebis-, 829^a.
 C₁₇H₁₃N₂O 2 - Naphthol, 6 - methyl - 1 - phenylazo-, 2819^a.
 Succinonitrile, α - *p* - anisyl - β - phenyl-, 2198^a.
 C₁₇H₁₃N₂O₂ Leucoisindigotin, 7 - methyl-, 1706^a.
 Pyrazinoacid - 1(2) - one, 3 - acetyl - 3,7-dihydro-, 295^a.
 C₁₇H₁₃N₂O₂ Isatan, 7-methyl-, 1706^a.
 Pyrazinoacidine - 3(7) - acetic acid, 1,2-dihydro - 1 - keto-, 296¹.
 C₁₇H₁₃N₂O₄ Tolunitrile, α - dimethoxybenzal-nitro-, 1419^a, 1420¹.
 —, 3 - nitro - α - veratral-, 1420¹.
 C₁₇H₁₃N₂O₅ Benzenesulfonic acid, *p* - (2 - hydroxy - 6 - methyl - 1 - naphthylazo), and Na salt, 2819^a.
 C₁₇H₁₃N₂O₅ *p* - Toluic acid, α - (*p* - acetamidobenzal) - 3 - nitro-, 1420¹.
 C₁₇H₁₃N₂O₇ Ferulic acid, α - benzamido - 5 - nitro-, 2652^a.
 C₁₇H₁₃N₂O₈ Lepidine, 7 - methoxy-, picrate, 992^a.
 2 - Naphthylamine, 7 - methoxy-, picrate, 497^a.
 Quinaldine, 7-methoxy-, picrate, 293^a.
 C₁₇H₁₃N₂O₈ Creatinine, 5 - benzal-, picrate, 1853¹.
 C₁₇H₁₃O Indone, 2 - methyl - 3 - phenyl-, 2208⁷.
 Pentadienone, 1,5-diphenyl-, 1258^a, 1410⁷, 2329⁷.
 C₁₇H₁₃O₂ 1(2) - Benzofuranone, 2 - allyl - *p*-phenyl-, 1277^a.
 Furan, 3 - methoxy - 2,5 - diphenyl-, 1268^a.
 Quinone, m. 154°, from compd. from *d*-methylpimaric, 648^a.
 C₁₇H₁₃O₂S Sulfone, 1-naphthyl *p*-tolyl-, 2483¹.
 C₁₇H₁₃O₂ Δ² - 1,4 - Butenedione, 2 - methoxy-1,4 - diphenyl-, 1268^a.
 3 - Pentadienone, 1,5 - disalicyl-, 485^a.
 Thebenol, 1423⁷.
 C₁₇H₁₃O₄ 2 - Benzofuranacetic acid, 1,2 - dihydro - 1 - keto - 4 - methyl - 2 - phenyl-, 1277¹.
 2(1) - Benzofuranone, 1 - veratral-, 1260⁴.
 Chalcone, 4' - methoxy - 3,4 - methylenedioxy-, 823^a.
 1,2-ββ - Naphthopyran - 4 - acetic acid, 2-keto-, Et ester, 824¹.
 9 - Phenanthrenecarboxylic acid, 9,10-dihydro - 2,3(or 3,4) - methylenedioxy-, Me ester, 499^a.
 C₁₇H₁₃O₄ Anthraquinone, hydroxydimethoxymethyl-, 652^a, 2491^a.
 Chalcone, 2' - hydroxy - 4' - methoxy - 3,4-methylenedioxy-, 823^a.
 Rotenone, 3483^a.
 2,9' - Spiro[1,2 - pyran - xanthen] - 6(5)-one, 3,4 - dihydro - 3',6' - dihydroxy-, 986^a.
 C₁₇H₁₃O₄ Anthraquinone, 7 - hydroxy - 1,2,6-trimethoxy-, 2491^a.
 C₁₇H₁₃AsO₃ Methyl - 1 - naphthylsulfophenyl arsonium oxide, 2338^a.
 C₁₇H₁₃BrO₂ Chalcone, α - bromo - β - ethoxy-, 43^a.
 C₁₇H₁₃BrO₂ Anthrone, 8 - bromo - 5, hydroxy-1,2 - dimethoxy - 6 - methyl-, 500¹.
 C₁₇H₁₃BrO₂ Meconin, 2 - (5 - bromo - 2,3 - cresyl)-, 500¹.
 Phthalide, 2 - (bromocresyl) - 5,6 - dimethoxy-, 2490^a.
 C₁₇H₁₃ClO₂ 2 - Anisyl - 5,7 - dihydroxy - 3 - methoxybenzopyrylium chloride, 2342^{1,2,3}.
 C₁₇H₁₃ClO₂ 2 - *p* - Anisyl - 5,7 - dihydroxy - 3-methoxybenzopyrylium perchlorate, 2342^a.
 C₁₇H₁₃O₂ 5,7 - Dimethoxy - 2 - phenylbenzopyrylium iodide, 2341^a.
 C₁₇H₁₃NO 2 - Naphthol, 1 - *p* - toluino-, 2602⁷.
 1 - Naphthylamine, 4 - methoxy - *N* - phenyl-, 2493^a.
 Pentadienone, (*m* - aminophenyl)phenyl-, and salts, 1266^a, 1268^a.
 C₁₇H₁₃NO₂ Chalcone, 3 - acetamido-, 1571¹.
 1,3(2,4) - Isoquinolinone, 2 - phenethyl-, 2958⁷.
 C₁₇H₁₃NO₂ Δ² - Isoxazoline, 5 - (*p* - hydroxyphenyl) - 3 - phenyl-, acetate, 1415^a.
 C₁₇H₁₃NO₂ Benzil, *p* - methoxy-, oxime, Acetderiv., 2819^a.
 Cinnamic acid, *p* - nitro - α - phenyl-, ethyl ester, 2817^a.
 C₁₇H₁₃O₃S Naphthalenesulfonic acid, hydroxy - *p* - toluino-, and salts, 2662^a.
 Phenol, *m* - armino, naphthalenesulfonate, 650^a.

- C₁₇H₁₅NO₅ Hippuric acid, α -vanilal-, 2040^a.
Nitron, *N*-(*p*-carboxyphenyl)- α -(3,4-methylenedioxyphenyl)-Et ester, 473.
- C₁₇H₁₅N₂O₅ 1-Naphthalenesulfonic acid, 8-*p*-sulfonamido-, and *Na* salt, 2662^a.
- C₁₇H₁₅NO₄ Toluic acid, α -dimethoxybenzalmi-
tro-, and salts, 1419^a, 1420¹.
—, α -hydroxy-, Et ester, *p*-nitrobenzoate, 1417^a.
—, 3-nitro- α -veratral-, and *K* salt, 1420^{1,2}.
- C₁₇H₁₅N₂NaO₅ 1(2), 1' - Spiro[benzofuran-benzothiazoline]-2-one, 5'-dimethylamino-5-methoxy-, *Na* deriv., 2047^a.
- C₁₇H₁₅N₂ 2-Naphthylamine, 1-tolylazo-, 2496^a.
Pyrrole, *p*-anisylazo-1 (and 2)-phenyl-, 2203^a.
Quinoline, 1,2-dihydro-1-methyl-2-(phenylazomethylene)-, -HCl, 289¹.
- C₁₇H₁₅N₂O 2-Naphthylamine, 1-*p*-tolylazoxy-, 2496^a.
- C₁₇H₁₅N₂O₅ 2(3)-Tetrazolone, 4-phenyl-, anisylhydrazine, 832^a.
- C₁₇H₁₅N₂O₃ 3-Indoleglyoxylic acid, Me ester, phenylhydrazine, 279^a.
Isoindoloquinolizaline, 2,3-dimethoxymethyl-, and methiodide, 2956^a.
- C₁₇H₁₅N₂O₃ 1-Acridineglycine, *N*-nitroso-, Et ester, 295^a.
- C₁₇H₁₅N₂O₄ 2-Benzeneazomethylol-1,2-dihydro-1-methylquinoline-4'-sulfonic acid, and *Na* salt, 289^{2,3}.
- C₁₇H₁₅N₂O₃ 1(2), *o*-Quinoxalinebenzoic acid, 3,4-dihydro-2-keto-4-nitroso-, Et ester, 294^a.
- C₁₇H₁₅N₂O₇ Indazole, 2-allyl-5-methyl-, picrate, 511^a.
Isoindazole, 1-allyl-5-methyl-, picrate, 511^a.
- C₁₇H₁₅N₂O₄S Imidazole, 2-ethylmercapto-1-phenyl-, picrate, 1710¹.
- C₁₇H₁₅N₂O₄ Vasicine, picrate, 2501^a.
- C₁₇H₁₅ Compd., m. 81°, from *d*-methylpimaric, 648^a.
- C₁₇H₁₅Br₂N₂ Glutaconaldehyde, bis(*p*-bromophenylhydrazine), 517^a.
- C₁₇H₁₅Br₂N₂O Benzophenone, 3,5,3',5'-tetra-bromo-4,4'-bis(dimethylamino)-, 1265^a.
- C₁₇H₁₅ClNO₂ Isobutyranilide, β -chloro- α -hydroxy-, benzoate, 264^a.
- C₁₇H₁₅N₂O₄ *o*-Toluidine, 4-iodo-, picrolonate, 2192^a.
- C₁₇H₁₅N₂ α,γ -Pentadienaldehyde, δ -phenyl-, phenylhydrazine, 2941¹.
1,3-Pentadiene, 1-allylino-5-phenylimino-, perchlorate, 2188^a.
 $\Delta^{1,2}$ -Pentadienylamine, *N*-phenyl- ϵ -phenylimino-, and derivs., 1267^a.
Quinaldine, 4-(*N*-methylamino)-, 1279^a.
Quinoline, 4-anilino-1,2-dihydro-1-methyl-2-methylene(?), 1279^a.
- C₁₇H₁₅N₂O Acridine, 1-(*N*-ethylacetamido)-, 295^a.
Pyrazinoacridine, 3-acetyl-1,2,3,7-tetrahydro-, 295^a.
 δ -Pyrazoline, 1-acetyl-3,5-diphenyl-, 283^a.
—, 1-benzoyl-3-methyl- δ -phenyl-, 283^a.
- C₁₇H₁₅N₂O₅ Benzothiazol-, 1-(*N*-acetyl-*m*-toluino)-4-methyl-, 1418^a.
- C₁₇H₁₅N₂O₃ 1-Acridineacetone, Et ester, 2084^a.
- 2(1)-Benzofuranone, 1-(*p*-dimethylamino-phenylimino)-5-methoxy-, 2046^a.
1,1-Cyclopropanedicarboxanilide, 2208^a.
Isoquinoline, 1,2-dihydro-2-methyl-1-*o*-nitrobenzyl-, 2500¹.
- C₁₇H₁₅N₂O₃ 1-Acridineglycine, 5-keto-, Et ester, 294^a.
2(1)-Benzofuranone, 1-(dimethylamino-phenylimino)-5-methoxy-, 2047^a.
1(2), *o*-Quinoxalinebenzoic acid, 3,4-dihydro-2-keto-, Et ester, 294^a.
- C₁₇H₁₅N₂O₅ Hydantoin, 1,3 (and 3,5)-di-*p*-anisyl-2-thio-, 637^a.
1(2), 1' - Spiro[benzofuran-benzothiazoline]-2-one, 5'-dimethylamino-5-methoxy-, 2047^a.
- C₁₇H₁₅N₂O₄ Hydantoin, di-*p*-anisyl-, 637^a.
Terephthalonic acid, 2,6-dimethyl-, phenylhydrazine, 482^a.
p-Toluic acid, α -(*p*-aminobenzal)-3-nitro-, Et ester, 1420^a.
o-Toluidine, *N*-acetyl- α -*p*-anisyl-4-nitro-, 491^a.
- C₁₇H₁₅N₂O₃ Codeinone, Nitrosonorhydroxy-, 299^a.
Tyrosine, *N*-*p*-nitrobenzal-, Me ester, 243^a.
- C₁₇H₁₅N₂O₄ *o*-Toluidine, 4-nitro-, naphthalenesulfonate, 650^a.
C₁₇H₁₅N₂O₄ Anthranilic acid, *N*-(carboethoxymethyl)-*N*-(*o*-nitrophenyl)-, 521^a.
- C₁₇H₁₅N₂O₄ 2-Pyrrolidone, 1-*p*-tolyl-, picrate, 2665^a.
- C₁₇H₁₅N₂O₃ Creatinine, 5-benzyl-, picrate, 1853^a.
Picrate, m. 174-5°, of the product from creatinine and PhCH₂Cl, 1853^a.
- C₁₇H₁₅O₇ 1(2)-Benzofuranone, 2-ethyl-4-methyl-2-phenyl-, 1277^a.
1,3-Butanedione, 2-benzyl-1-phenyl-, 1138^a.
9-Phenanthrenecarboxylic acid, 9,10-dihydro-10-methyl-, Me ester, 499^a.
- C₁₇H₁₅O₂ 2-Butanone, 4-(*m*-hydroxyphenyl)-, benzoate, 2044^a.
Chalcone, dimethoxy-, 823^a, 1410^a.
—, 4-ethoxy-4'-hydroxy-, 3064^a.
Chromanol, phenyl-, acetate, 2864^a.
Isocugenol, benzoate, 260^a.
9-Phenanthrenecarboxylic acid, 9,10-dihydro-3-methoxy-, Me ester, 499^a.
2-Propanone, 3-hydroxy-1,1-diphenyl-, acetate, 2206^a.
- C₁₇H₁₅O₄ Anthrone, hydroxydimethoxymethyl-, 652^a, 2491^a.
2(1)-Benzofuranone, 1-veratryl-, 1260^a.
Chalcone, hydroxydimethoxy-, 982^a, 2441^a.
Lapacic acid, acetate, 828^a.
Propanedione, 1,3-di-*p*-anisyl-, 1410^a.
—, 1-(3,4-dimethoxyphenyl)-3-phenyl-, and *Cu* salt, 2955^a.
Propiophenone, *p*-methoxy- β -(3,4-methylenedioxyphenyl)-, 823^a.
p-Toluic acid, α -hydroxy-, Et ester, benzoate, 1412^a.
- C₁₇H₁₅O₄ Acid from the marking nut, 3607^a.
Anthrone, 7-hydroxy-1,2,6-trimethoxy-, 2491^a.
Cresotic acid, Me ester, cresate, 51^a, 52^a.
Phthalide, 2-(2,6-cresyl)-5,6-dimethoxy-, 2490^a.
Propiophenone, 2-hydroxy-4-methoxy- β -(3,4-methylenedioxyphenyl)-, 823^a, 2491^a.

- C₁₇H₁₅O₄ Veratric acid, 2 - (3 - methylsalicylyl)-, 652^o.
- C₁₇H₁₅O₇ Benzil, 2,4 - dihydroxy - 3',4,5' - trimethoxy-, 2946^o.
- C₁₇H₁₅O₈ Benzil, 2,4,6 - trihydroxy - 3',4',5' - trimethoxy-, 2946^o.
- C₁₇H₁₇BrN₂O₂ Glyoxylic acid, *p* - bromophenyl-, Me ester, 2,4 - xylylhydrazone, 1853^o.
- Malonamide, *N* - benzyl - α - bromo - *N'* - *p*-tolyl-, 1697^o.
- p* - Malonotoluide, α - bromo, 1697^o.
- C₁₇H₁₇BrN₂O₂ Glyoxylic acid, *p* - bromophenyl-, azo-, Me ester, 2,4 - xylylhydrazone, 1852^o.
- C₁₇H₁₇BrO₄ Veratric acid, 6 - (5 - bromo - 2,3 - cresylmethyl)-, 500^o.
- C₁₇H₁₇N₂ 4 - Anilino - 1,2 - dimethylquinoxinium iodide, 1279^o.
- C₁₇H₁₇NO Acetophenone, α - (1,2,3,4 - tetrahydro-one-quinazyl)-, 511^o.
- Chalcone, 4 - dimethylamino-, salts, 1266^o.
- Isocarbostyryl, 3,4 - dihydro - 2 - phenethyl-, 2958^o.
- Nitro-, α - styryl - *N* - 2,5 - xylyl-, 1250^o.
- C₁₇H₁₇NO₃ (See also *Apomorphine*.)
- Glutarimide, α,γ - dimethyl - *N* - naphthyl-, 2477^o.
- Norhydrastinine, 1 - benzyl - 1,2 - dihydro - and -HCl, 2959^o.
- C₁₇H₁₇NO₃ *o* - Toluic acid, α - (*N* - phenethyl-carbamyl)-, 2958^o.
- C₁₇H₁₇NO₃ Aniline, *N* - methyl-, naphthalene-sulfonate, 650^o.
- Malonic acid, α - acetyl - *N* - 1 - naphthyl - β - thio-, Et ester, 471^o.
- Toluidine, naphthalenesulfonate, 650^o.
- C₁₇H₁₇NO₄ Carbamic acid, benzylhydroxy-, Et ester, benzoate, 969^o.
- Codeinone, norhydroxy-, and -HBr, 299^o.
- Dibenzamide, 2' - hydroxy - 2 - methoxy - 3(4 and 5) - methyl-, 1417^o.
- Isobutyranilide, α - hydroxy-, salicylate, 264^o.
- p* - Toluic acid, α - hydroxy-, Et ester, *p*-aminobenzoate, and -HCl, 1417^o. Et ester, carbanilate, 1417^o.
- C₁₇H₁₇NO₃ Anisidine, naphthalenesulfonate, 650^o.
- C₁₇H₁₇NO₄ Nicotinic acid, 5 - acetyl - 4 - *p*-anisyl - 1,6 - dihydro - 6 - keto - 1,2 - dimethyl-, 2497^o.
- C₁₇H₁₇N₂O Δ^2 - Pyrazoline, methylphenylphenyl-carbamyl-, 283^o.
- C₁₇H₁₇N₂O₂ Benzaldehyde, 4 - *m* - carbethoxy-phenyl-gmicarbazone, 1130^o.
- Indoloquinoxaline, 2,3 - dimethoxy-, methoxyhydroxide, 2956^o.
- C₁₇H₁₇N₂O₂ Glyoxylic acid, *p* - nitrophenyl, Me ester, 2,4 - xylylhydrazone, 1852^o.
- C₁₇H₁₇N₂O₂ Glyoxylic acid, *p* - nitrophenylazo-, Me ester, 2,4 - xylylhydrazone, 1852^o.
- C₁₇H₁₇N₂O₂ Imidazole, 4,5 - dihydro - 4,5 - dimethyl - 2 - phenyl-, picrate, 984^o.
- C₁₇H₁₇ClNO₂ 3,6 - Dimethoxy - 10 - ethylacridinium chloride, P 3567^o.
- C₁₇H₁₇ClNO₂ 3,6 - Dimethoxy - 10 - hydroxy-ethylacridinium chloride, P 3567^o.
- p* - Toluidine, *N* - (α - chloro - 3,4,5 - trimethoxybenzyl)-, and chlorostannate, 2651^o.
- C₁₇H₁₇ClNO₂ *p* - Anisidine, *N* - (α - chloro - 3,4,5 - trimethoxybenzyl)-, and chlorostannate, 2651^o.
- C₁₇H₁₇NO Oxazolidine, 3 - *p*-tolyl - 2 - *p*-tolyl-imino-, 2481^o.
- C₁₇H₁₇N₂O₂ Acridan, 1 - (β - hydroxyethylamino)-mono-Ac deriv., 295^o.
- Acridine, 1 - (formylmethyl)amino-, di-Me acetal, 295^o.
- Glyoxylic acid, phenyl-, Me ester, 2,4 - xylylhydrazone, 1852^o.
- Malonamide, *N* - benzyl - *N'* - *p*-tolyl-, 1697^o.
- C₁₇H₁₇N₂O₂ Anthranilic acid, *N* - (*o* - acetamidophenyl) - *N* - ethyl-, 987^o.
- C₁₇H₁₇N₂O₂ 2(1) - Benzofuranone, 1 - (*p* - dimethylaminoanilino) - 1 - mercapto - 5 - methoxy-, 2047^o.
- C₁₇H₁₇N₂O₂ Codeinone, nitrosonordihydrohydroxy-, 299^o.
- C₁₇H₁₇N₂O₂ Benzothiazole, 1 - (3,4 - dimethyl-anilino) - 3,5 - dimethyl-, 1419^o.
- Thiazolidine, 3 - tolyl - 2 - tolylimino-, 2481^o.
- C₁₇H₁₇N₂O₂ Glyoxylic acid, phenylazo-, Me ester, 2,4 - xylylhydrazone, 1852^o.
- C₁₇H₁₇N₂O₂ Acetophenone, α - (ethylmethylamino)-, picrate, 511^o.
- Indoline, methoxy - 1,2 (and 1,3) - dimethyl-, picrate, 2049^o.
- 2 - Naphthylamine, tetrahydro - 7 - methoxy-, picrate, 497^o, 498^o.
- C₁₇H₁₇N₂O₂ Isoquinoline, 1,2,3,4 - tetrahydro-6,7 - dimethoxy-, picrate, 2955^o.
- C₁₇H₁₇O Valerophenone, β -phenyl-, 982^o.
- C₁₇H₁₇O₂ 1 - Propanol, 1,3 - diphenyl-, acetate, 2331^o.
- Xanthidol, 9 - butyl-, and perchlorate, 983^o.
- C₁₇H₁₇O₂ Acetophenone, *p* - methoxy - α - (*p*-methoxybenzyl)-, 58^o.
- Benzophenone, 4,4' - dimethoxy - 3,3' - dimethyl-, 2486^o.
- Propiophenone, β - *p*-anisyl - *p* - methoxy-, 823^o.
- C₁₇H₁₇O₂ Diketone, m. 185^o, from thebenone, 2827^o.
- Mangostin, methyl-, 828^o.
- C₁₇H₁₇O₂ Mandelic acid, *p* - methoxy- α -*p*-methoxybenzyl-, 1419^o.
- o* - Veratric acid, 6 - (2,3 - cresylmethyl)-, 500^o.
- , 6 - (hydroxymethylbenzyl)-, 2491^o.
- C₁₇H₁₇O₂ + H₂O *o* - Veratric acid, 6 - vanillyl-, 2491^o.
- C₁₇H₁₇AsI₄ Allyl-methyl-diphenylarsonium iodide, CHI₃ addn. compd., 1403^o.
- C₁₇H₁₇ClO Camphor, 3 - *o* - chlorobenzal-, 2655^o.
- C₁₇H₁₇Hg(NO₂)₂ *o* - Acetotoluide, 3,4,5,6 - tetra-(hydroxymercuro)-, tetraacetate, 2647^o.
- C₁₇H₁₇N Indanamine, *N* - benzyl - *N* - methyl-, Isoquinoline, 1,2,3,4 - tetrahydro - 2 - phenethyl-, and -HCl, 2958^o.
- C₁₇H₁₇NO *p* - Hydratropotoluide, *p* - methyl-, 277^o.
- Valerophenone, oxime, 982^o.
- C₁₇H₁₇NO₂ Benzamide, *N* - α - (α - hydroxy-isopropyl)benzyl-, 3254^o.
- C₁₇H₁₇NO₂ (See also *Morphine*.)
- Acetophenone, *p* - methoxy - (*p*-methoxybenzyl)-, oxime, 58^o.
- Benzophenone, 4,4' - dimethoxy - 3,3' - dimethyl-, oxime, 2486^o.
- Propiophenone, β - *p*-anisyl - *p* - methoxy-, oxime, 982^o.
- C₁₇H₁₇NO₂ Acetophenone, *p*, α , α - trimethoxy- α -phenyl-, oxime, 2819^o.

- Benzamide, *N* - benzyl - 3, 4, 5 - trimethoxy-, and chlorostannate, 2651¹.
- Benztoluide, 3, 4, 5 - trimethoxy-, 2651¹.
- Camphone, nordihydrohydroxy-, -HCl, 269¹.
- Thebenone, monoisinitroso-, 2827¹.
- C₁₇H₁₃NO₅ Benzamide, 3, 4, 5 - trimethoxy-, 2651¹.
- C₁₇H₁₃N₂O Butanone, diphenyl-, semicarbazide, 1269¹, 3486¹.
- C₁₇H₁₃N₂O₂ Propiophenone, 2, 4 - dimethyl-, *p* - nitrophenylhydrazine, 1408¹.
- Semicarbazide, 1 - benzoylisopropylphenyl-, 642¹.
- C₁₇H₁₃N₂O Acetamide, *N* - (glyoxylmethyl)-, phenylosazone, 1827¹.
- C₁₇H₁₃N₂O₂ Isonopilocarpine, picrate, 1709¹.
- Neopilocarpine, picrate, 1709¹.
- Pilocarpidine, 2, 4, 6 - trinitro - *m* - cresol salt, 2053¹.
- Propane, 2, 2 - dibenzyl-, 1138¹.
- C₁₇H₁₃N₂O Indanamine, *N* - (aminoxyl)-, 1520¹.
- Isoquinoline, 1 - (*o* - aminobenzyl) - 1, 2, 3, 4 - tetrahydro - 2 - methyl-, and salts, 2500¹.
- Piperazine, 2 - methyl - 1, 4 - diphenyl-, 492¹.
- C₁₇H₁₃N₂O Benzophenone, *p*, *p'* - bis(dimethyl-amino)-, 490¹, 1265¹, 2473¹.
- Camphoceanic acid, 3 - (methyl - 2 - benzimidazolyl)-, cyclic amide, 2494¹.
- Camphonanac acid, 3 - (methyl - 2 - benzimidazolyl)-, cyclic amide, 2494¹.
- Carbanilide, tetramethyl-, 642¹.
- Centralite, 2133¹.
- Propiophenone, *p* - methoxy-, phenylhydrazine, 266¹.
- C₁₇H₁₃N₂O₂ Carbanilide, α - (β - hydroxyethyl)-dimethylthio-, 2481¹.
- C₁₇H₁₃N₂O₂ Acridan, 1 - (formylmethyl)amino-, di-Me acetal, 265¹.
- C₁₇H₁₃N₂O₂ Camphorimide, *N* - nitrobenzyl-, 269¹.
- Dioxime, m. 260¹, of diketone from thebenone, 2827¹.
- 4 - Isopyrrolecarboxylic acid, 2 - (4 - acetyl-3, 5 - dimethyl - 2 - pyrrolmethyl)-3 - hydroxy - 5 - methyl-, Et ester, 74¹.
- 3 - Pyrrolecarboxylic acid, 5 - (4 - acetyl-3, 5 - dimethyl - 2 - isopyrrolidenemethyl)-4 - hydroxy - 2 - methyl-, Et ester, 75¹.
- C₁₇H₁₃N₂O₂ 4, 5' - Bipyrrrole - 3 - carboxylic acid, 5 - formyl - 4' - hydroxy - 2, 2' - dimethyl-, di-Et ester, 75¹.
- C₁₇H₁₃N₂O₂ Carbanilide, 2, 5, 2', 5' - tetramethylthio-, 2481¹.
- C₁₇H₁₃N₂O₂ Pentanone, 1 - hydroxy-, osazone, 1558¹.
- C₁₇H₁₃N₂O₂ Acetic acid, alkoxyformyl-, phenylhydrazide, phenylhydrazine, 1992¹.
- 3, 5 - Pyrazolidone, 1 - tolyl ϵ (?), tolylhydrazine addn. compd., 1255¹.
- 5 - Pyrazolidone, 3 - hydroxy - 1 - tolyl (?), tolylhydrazine addn. compd., 1255¹.
- C₁₇H₁₃N₂O₂ Phenethylamine, ethoxymethoxy-, picrate, 2659¹.
- C₁₇H₁₃N₂O₂ Picrate, m. 158¹, of base made from chenopodium oil, 2042¹.
- C₁₇H₁₃O Camphor, benzal-, 11¹, 2655¹.
- (2) - Naphthalenone, benzalacetahydro-, 1270¹.
- 7 - Pentanone, α , γ - diallyl-, 1133¹.
- C₁₇H₁₃O₂ Anisole, *p*, *p'* - trimethyl-, 58¹.
- 5, 6' - Et - 2, 4 - xylenol, monomethyl ether, 1257¹.
- Cyclohexanone, 2 - cyclohexylidene - ϵ - (2-fural)-, 2611¹.
- Propiophenone, β - phenyl-, di-Me acetal, 1411¹.
- Pulgone, benzoate of enol form, 1136¹.
- C₁₇H₁₃O₂ Thebenone, 2827¹.
- C₁₇H₁₃O₂ Hydrocinnamic acid, α - acetyl - α allyl - β - keto - *o* - methoxy-, Et ester, 468¹.
- C₁₇H₁₃ClN₂O Pyronine, 733¹.
- C₁₇H₁₃ClO₂ Fenchyl alcohol, *p* - chlorobenzoate, 2657¹.
- C₁₇H₁₃N Diphenethylamine, *N* - methyl-, 2628¹.
- C₁₇H₁₃N₂O Cyclopentaneacetoneitrile, 3 - benzoyl - 2, 2, 3 - trimethyl-, 1703¹.
- C₁₇H₁₃N₂O Camphonanac acid, 3 - cyano-, benzyl and tolyl esters, 2658¹.
- Camphorimide, *N* - benzyl-, 269¹.
- Fenchone, benzoyloxime, 648¹.
- C₁₇H₁₃NO₂ Apoptropine ϵ N - oxide, and - HCl, 2670¹.
- Thebenone, oxime, 2827¹.
- C₁₇H₁₃NO₂ 6, 1, 5 - Tetrahydropyridine - 3 - carboxylic acid, 1, 7 - dihydro - 4 - iso butyl - 5, 7 - diketone - 1, 2 - dimethyl - 7 - thio-, Et ester, 2497¹.
- C₁₇H₁₃NO₂ (See also Cocaine; Hyoscyne.) Benzyl alcohol, 3, 4, 5 - trimethoxy - α - *p* - tolueno-, and - HCl, 2651¹.
- Fenchyl alcohol, *p* - nitrobenzoate, 2657¹.
- Pseudococaine, 1176¹.
- C₁₇H₁₃NO₂ Benzyl alcohol, 3, 4, 5 - trimethoxy - α - *p* - methoxyanilino-, and - HCl, 2651¹.
- Scopolamine, *N* - oxide, and salts, 2670¹.
- C₁₇H₁₃NO₂ Apoptropine, *N* - sulfonated ether, 2670¹.
- C₁₇H₁₃NO₂ Scopolamine, *N* - sulfonated ether, 2670¹.
- C₁₇H₁₃Br₂Mg₂N₂O Carbazide, dimagnesiumdibromide - diethylmagnesiumbromide - di phenyl-, 257¹.
- C₁₇H₁₃N₂ Phenethylamine, *N*, *N'* - methylenebis-, 1137¹.
- C₁₇H₁₃N₂O₂ Camphoceanic acid, 3 - (methyl-2 - benzimidazolyl)-, 2494¹.
- Camphonanac acid, 3 - (methyl-2 - benzimidazolyl)-, 2494¹.
- Fenchone, phenylcarbamoyloxime, 648¹.
- Ketone, 6 - methoxy - 4 - quinolyl ϵ - methyl aminoamyl, 656¹.
- C₁₇H₁₃N₂O₂ Camphoramic acid, *N* - nitrobenzyl-, 269¹.
- C₁₇H₁₃O Camphor, 3 - benzyl-, 2655¹.
- C₁₇H₁₃O₂ Naphthol, decahydro-, benzoate, 1270¹.
- C₁₇H₁₃O₂ 3 - Camphorylideneacetic acid, 2 - methyl - 3 - butyl - 2 - ol ester, 1414¹.
- Compd., m. 100-110¹, from cholic acid, 2683¹.
- C₁₇H₁₃O₂ Spiro[cyclohexane - 1, 1' - cyclopropane - 2', 1'' - cyclohexane] - 2, 6, 2'', 6'' - tetraone, 4, 4, 4'', 4'' - tetramethyl-, 1263¹.
- C₁₇H₁₃O₂ 1, 2 - Cyclopropanedicarboxylic acid, 1-ethoxy - 2 - phenyl-, di-Et ester, 2643¹.
- C₁₇H₁₃NO₂ 2 - Pyrrolepropionic acid, α , 4 - dicarboxy - α , β - diiodo - 3, 5 - dimethyl-, tri-Et ester, 2663¹.
- C₁₇H₁₃NO Benzamide, *N* - (decahydro - 1 - naphthyl)-, 1270¹.
- Isobornylane, 2 α - benzamido-, 269¹.
- C₁₇H₁₃NO₂ Carbanilic acid, thionobornyl ester, 57¹.

- $C_{17}H_{21}NO_2$ Benzoic acid, aminoborneol-ester, 126^o.
 Camphenilol, β -methyl-, phenylurethan, 2945^o.
 Carbanilic acid, decahydronaphthyl ester, 1270^o.
 α -Terpineol, phenylurethan, 486^o.
 $C_{17}H_{21}NO_2$ (See also *Atropine*; *Hyoscyamine*.)
 Camphoramic acid, *N*-benzyl-, 269^o.
 Cyclohexanebutyranilide, 2-carboxy-(?), 1270^o.
 Cyclohexanebutyric acid, 2-phenylcarbamy-
 (7), 1270^o.
 $C_{17}H_{21}NO_2$ Atropine, *N*-oxide, and $-HCl$, 2670^o.
 Hyoscyamine, *N*-oxide, and $-HCl$, 2670^o.
 $C_{17}H_{21}NO_2$ 2-Pyrroleacrylic acid, α ,4-dicarboxy-3,5-dimethyl-, tri-Et ester, 2664^o.
 $C_{17}H_{21}NO_2$ Atropine, *N*-sulfonated ether, 2670^o.
 Hyoscyamine, *N*-sulfonated ether, 2670^o.
 $C_{17}H_{21}NO_2$ Glycine, *N,N'*-propylidenebis-, 76^o.
 Serine, β -(3,4-dicarboethoxyoxyphenyl)-, Et ester, $-HCl$, 73^o.
 $C_{17}H_{21}NO_2$ Cyclohexenone, isopropylmethyl-, phenylsemicarbazone, 3485^o.
 $C_{17}H_{21}BrClMoN_2O_2$ 1386^o.
 $C_{17}H_{21}NO_2$ Cyclohexanol, 3-diethylamino-, *p*-nitrobenzoate, $-HCl$, 2196^o.
 Dinicotinic acid, 2-cyano-4-ethyl-1,2-dihydro-1,2,6-trimethyl-, di-Et ester, 2497^o.
 Quinoline, 6-acetamide-1-acetyl-1,2,3,4-tetrahydro-5,8-dimethoxy-2,4-dimethyl-, 2234^o.
 $C_{17}H_{21}O_2$ Benzofuran, 1-ethyl-1,2-dihydro-2,4-dimethyl-6-(α -methyl- Δ^2 -butenyl)-(?), 2038^o.
 Chroman, 2,4,6-trimethyl-8-(α -methyl- Δ^2 -butenyl)-(?), 2038^o.
 β -Cresol, 2,6-bis(α -methyl- Δ^2 -butenyl)-, 2038^o.
 $C_{17}H_{21}O_2$ 3-Bornylencarboxylic acid, 3-methyl-1-pentin-3-ol ester, 1418^o.
 $C_{17}H_{21}O_2$ 3-Camphaneacetic acid, 2-keto-, 2-methyl-3-buten-2-ol ester, 1418^o.
 3-Camphorylideneacetic acid, 3-methyl- Δ^2 -2-butenol ester, 1418^o.
 $C_{17}H_{21}O_2$ 1,3-Cyclohexanedione, 2,2'-methylenebis[5,5-dimethyl-, 1263^o.
 ϵ -Heptenic acid, α -acetyl- α,γ -dialkyl- β -keto-, Et ester, 466^o.
 Malonic acid, ethylphenethyl-, di-Et ester, 471^o.
 Santoninic acid, Et ester, 126^o.
 $C_{17}H_{21}O_2$ Malonic acid, (3-phenoxybutyl)-, di-Et ester, 471^o.
 $C_{17}H_{21}NO_2$ Cyclohexanone, 2-diethylamino-, benzoate, $-HCl$, 2^o.
 Menthol, carbanilate, 3266^o.
 $C_{17}H_{21}NO_2$ Aniline, *N*-methyl-, *d*-camphor-sulfonate, 2028^o.
 $C_{17}H_{21}NO_2$ Pyrrolecarboxylic acid, 4-(β,β -dicarboxyethyl)dimethyl-, tri-Et ester, 2336^o, 2823^o.
 $C_{17}H_{21}NO_2$ Lactic acid, α -phosphono-, di-*p*-toluidide salt, 2028^o.
 $C_{17}H_{21}NO_2$ Eseretholmethine, cyano-, 1427^o.
 4-Piperidone, 1-acetyl-2,2,6,6-tetramethyl-, phenylhydrazone, 507^o.
 $C_{17}H_{21}NO_2$ Humuquinone, semicarbazone, 1429^o.
 $C_{17}H_{21}NO_2$ 2-Hendecene, 2-phenyl-, 2475^o.
 $C_{17}H_{21}NO_2$ Urea, α -menthyl- β -phenyl-, 3266^o.
 $C_{17}H_{21}NO_2$ Carbamic acid, benzalbis-, butyl ester, 2478^o.
 $C_{17}H_{21}NO_2$ Urea, α -(2-isobutylcyclohexyl)- β -phenylthio-, 1862^o.
 $C_{17}H_{21}NO_2$ Δ^1 -1-Nonenol, 4,8-dimethyl-1-phenyl-, 2029^o.
 $C_{17}H_{21}O_2$ 3-Bornylencarboxylic acid, 3-methyl- Δ^1 -3-pentenol ester, 1418^o.
 3-Camphaneacetic acid, 3-methyl-1-pentin-3-ol ester, 1418^o.
 $C_{17}H_{21}O_2$ 3-Camphaneacetic acid, 2-keto-, 2-methyl- Δ^1 -2-butenol ester, 1418^o.
 3-Camphorylideneacetic acid, *tert*-Am ester, 1418^o.
 $C_{17}H_{21}O_2$ Δ^1 -Cyclohexenemalonic acid, 2-(carboxymethyl)-, tri-Et ester, 2329^o.
 $C_{17}H_{21}NO_2$ Dehydroeseretholmethine, methiodide, 1140^o.
 $C_{17}H_{21}N$ η -Octenylamine, γ,γ -dimethyl-*N*-*p*-tolyl-, 2029^o.
 $C_{17}H_{21}NO_2$ Benzoic acid, β -di-*sec*-butyl-aminethyl ester, P 153^o.
 $C_{17}H_{21}NO_2$ Dinicotinic acid, 4-ethyl-2,6-dimethyl-, di-Et ester, methosulfate, 2496^o.
 $C_{17}H_{21}N_2$ Hydrazine, α -(3,7-dimethyl- Δ^2 -octenyl)- α -*p*-tolyl-, 2029^o.
 $C_{17}H_{21}NO_2$ Benzoic acid, *p*-amino- β -di-*sec*-butylaminethyl ester, P 153^o.
 $C_{17}H_{21}NO_2$ Isobumulinic acid, disemicarbazone, 1429^o.
 $C_{17}H_{21}O_2$ 2-Hendecanol, 2-phenyl-, 2475^o.
 $C_{17}H_{21}O_2$ 3-Bornylencarboxylic acid, 3-methyl-3-pentanol ester, 1418^o.
 3-Camphaneacetic acid, 3-methyl- Δ^1 -3-pentenol ester, 1418^o.
 $C_{17}H_{21}O_2$ 3-Camphaneacetic acid, 2-keto-, *tert*-Am ester, 1418^o.
 Compd., m. 183-4^o, from cholic acid, 2683^o.
 $C_{17}H_{21}NO_2$ Hydroeseretholmethine, methiodide, and $ZnCl_2$ salt, 1427^o.
 $C_{17}H_{21}NO_2$ 2-Indolol, 3-(γ -dimethylamino-propyl)-6-ethoxy-2,3-dihydro-1-methyl-, methiodide, and $ZnCl_2$ salt, 1427^o.
 $C_{17}H_{21}O_2$ 3-Camphaneacetic acid, 3-methyl-3-pentanol ester, 1418^o.
 Fenchyl alcohol, enanthate, 2657^o.
 $C_{17}H_{21}NO_2$ Urea, α -bis(α -ethoxy- α -ethyl-butyl)-, 1130^o.
 $C_{17}H_{21}O_2$ Cyclohexaneacetic acid, α -hydroxy-, nonyl ester, 982^o.
 Tridecoic acid, α -acetyl-, Et ester, 1128^o.
 $C_{17}H_{21}O_2$ Malonic acid, bis(ϵ -methylbutyl)-, di-Et ester, 464^o.
 $C_{17}H_{21}NO_2$ Pentadecylaldehyde, semioxamazone, 3251^o.
 $C_{17}H_{21}NO_2$ Carbamic acid, (diethylaminoethyl)-methyl ester, and $-HCl$, P 1757^o.
 $C_{17}H_{21}O_2$ Heptadecanone, 1692^o, 2807^o.
 $C_{17}H_{21}NO_2$ Sphingosine, 2027^o.
 $C_{17}H_{21}O_2$ Heptadecane, 1692^o.
 $C_{17}H_{21}NO_2$ Ether, cetyl methyl, 759^o.
 $C_{17}H_{21}NO_2$ Heptadecylamine, 3396^o.
 $C_{17}H_{21}NO_2$ 2-Heptadecanol, 1-amino-, 2027^o.
 Sphingine, 2027^o.
 $C_{17}H_{21}NO_2$ Triphenodioxazine, 3,10-dibromo-, 2340^o.
 $C_{17}H_{21}Cl_2NO_2$ Triphenodioxazine, 3,10-dichloro-, 2340^o.

- C₁₃H₉BrO₅ 3,4' - Bicomarin, 6 - bromo - 7' - hydroxy-, 824⁴.
- C₁₃H₁₁NO Addn. compd., m. 119-21°, of perchlorindone and skatole, 1258⁴.
- C₁₃H₉N₃O₅ 1,2 - β - Naphthofurandione, picrate, 814⁴.
- C₁₃H₉N₃O₁₀ 2,1,3 - Benzotriazole, 2 - [dinitro-4,6 - (2,4,6 - trinitroanilino)phenyl]-, 515¹.
- C₁₃H₁₂Br₂N₂O₃ p - Phenylenediamine, N¹, N⁴-bis(2 - bromo - 4,6 - dinitrophenyl)-, 981¹.
- C₁₃H₁₀Br₂O₅ 2 Thioindigo, 4,4' - dibromo - 5,5' - dimethoxy-, 2338³.
- C₁₃H₁₀Br₂O₅ Oxindigo, 4,4' - dibromo - 5,5' - dimethoxy-, 2047⁷.
- Oxindirubin, 4,4' - dibromo - 5,5' - dimethoxy-, 2047⁸.
- C₁₃H₁₀N₂O 1,3 - Benzodiazole, 1,2(1',8') - naphthylene-, 830⁸.
- Naphthofuroquinoxaline, 64⁸, 2047¹.
- C₁₃H₁₀N₂O₃ Triphenodioxazine, 1283⁴.
- C₁₃H₁₀N₂O₄ Naphthalic anhydride, 3 - hydroxy-4-phenylazo-, 275⁸.
- C₁₃H₁₀O₂ 1,2 - Benzanthrene - 7,12 - dione, 2335⁷.
- C₁₃H₁₀O₂ 2(1) - Thionaphthenone, 1 - (hydroxyketonaphthylidene)-, 2493⁴.
- C₁₃H₁₀O₃ 3,4' - Bicomarin, 7' - hydroxy-, 824⁴.
- C₁₃H₁₁ClN₂O₂ 2(10) - Phenazinone, 8 - chloro-3 - hydroxy - 10 - phenyl-, 1283⁴.
- C₁₃H₁₁ClO₂ 1 - Naphthyl chloride, 8 - benzoyl-, 497².
- C₁₃H₁₁ClO₂ 2 - Naphthoic acid, 4 - (o - chlorobenzoyl) - 1 - hydroxy-, P 300².
- C₁₃H₁₁NO 7 - Acenaphthenone, 8 - phenylimino-, 2337⁸.
- C₁₃H₁₁NO₂ 1,2 - Benzanthrene, 7(or 12) - nitro-, 2335⁷.
- Naphthofuranone, phenylimino-, 64⁸, 2046⁸, 2047².
- C₁₃H₁₁NO₂ 2(1) - Thionaphthenone, 1 - (4-amino - 1 - keto - 2(1) - naphthylidene)-, 6493⁴.
- C₁₃H₁₁NO₃ Isoquinoline, 6,7 - methylenedioxy-1 - (3,4 - methylenedioxybenzoyl)-, and -H₁, 2671².
- C₁₃H₁₁N₂O₃ 2,1 - β - Pyridoquinazol - 11 - one, picrate, 1282².
- C₁₃H₁₁N₂O₃ 2,1,3 - Benzotriazole, 2 - [p - (2,4,6-trinitroaniline)phenyl]-, 515¹.
- C₁₃H₁₂ 1,2-Benzanthrene, 2300³.
- C₁₃H₁₂Br₂O₃ 1,2(1',8') - Bibenzofuran - 2 - one, 4,4' - dibromo - 1' - hydroxy - 5,5' - dimethoxy-, 2047⁸.
- C₁₃H₁₁ClNO₂ Acetanilide, N - (3 - chloro - 1,4-dihydro - 1,4 - diketo - 2 - naphthyl)-, 2820⁸.
- C₁₃H₁₂Cl₂O₄ 9,10 - Anthradiol, 1,5 - dichloro-, diacetate-, 2489⁸.
- C₁₃H₁₂Cl₂OP Phosphine oxide, tris(chlorophenyl)-, 980¹.
- C₁₃H₁₂FeK₂O₄ + 2H₂O Potassium ferripyrocatecholate, 1999⁸.
- C₁₃H₁₂NO₂ Codeinone, dihydro-, P 1575¹.
- C₁₃H₁₂N₂O Quinoxaline, 2 - (2 - hydroxy - 1 - naphthyl)-, 2047¹.
- C₁₃H₁₂N₂O₂ 2,8' - Benzimidazole - 1 - naphthoic acid, 830⁸.
- Indole, oxalybis-, 279⁴.
- Naphthalimide, N - (o - aminophenyl)-, 2 - β - Naphthimidazole - o - benzoic acid, 830⁸.
- 4,9 - β - Naphthimidazoledione, 2 - methyl-1-phenyl-, 2820⁸.
- 1,2 - β - Naphthofurandione, phenylhydrazone, 64⁸.
- 2 - Quinoxalinol, C - (hydroxynaphthyl)-, 2047¹.
- C₁₃H₁₂N₂O₃ Oxindole[Δ^{1,8'}]rhodanine, 3'-tolyl-, 1422².
- C₁₃H₁₂N₂O₃ Oxindole[Δ^{1,8'}]rhodanine, 3' - o(and p) - anisyl-, 1422².
- C₁₃H₁₂N₂O₃ Isoquinoline, 6,7 - methylenedioxy-1 - (3,4 - methylenedioxybenzoyl)-, oxime, 2671².
- C₁₃H₁₂N₂OP Phosphine oxide, tris(nitrophenyl)-, 980¹.
- C₁₃H₁₂N₂O₃ Isocyanic acid, dibenzoyl-, 2807⁸.
- C₁₃H₁₂N₂O₃ 2,1,3 - Benzotriazole, 2,2' - (4,6-dihydroxy - m - phenylene)bis-, 514¹.
- C₁₃H₁₂N₂O₃ 2,1,3 - Benzotriazole, 2 - [4 - hydroxy - 3 - (nitrophenylazo)phenyl]-, 514¹.
- C₁₃H₁₂N₂O₃ Resorcinol, bis(o - nitrophenylazo)-, 514¹.
- C₁₃H₁₂O 1,2 - Benzanthrene, 2335⁷.
- C₁₃H₁₂O 2(1) - β - Naphthofuranone, 1 - phenyl-, 2044⁴.
- C₁₃H₁₂O 1 - Naphthoic acid, 8 - benzoyl-, 47².
- C₁₃H₁₂O 2 - Naphthoic acid, 4 - benzoyl - 1 - hydroxy-, P 300².
- C₁₃H₁₂O₂ Oxindigo, 5,5' - dimethoxy-, 2047⁸.
- Oxindirubin, 5,5' - dimethoxy-, 2047⁸.
- Phenanthrenequinone, 2,7 - dihydroxy-, diacetate, 1569⁸.
- C₁₃H₁₂O Anthragallol, diacetate, 3270⁴.
- C₁₃H₁₂AsClN γ - Benzophenarsazine, 7 - (β-chlorovinyl) - 7,12 - dihydro-, 3250⁴.
- C₁₃H₁₂BrClNO₂ 1 - Naphthoic acid, m - toluidine, 5-bromo - 5' - chloro - 6' - hydroxy-, 1562⁸.
- C₁₃H₁₂BrO₂ Compd. from 2 - methyl - 5 - benzofuranol and Br, 2665⁴.
- C₁₃H₁₂ClO₂ Compd. from 2 - methyl - 5 - benzofuranol and Cl, 2665⁴.
- C₁₃H₁₂IN₂O 2,1 - β - Pyridoquinazol - 11 - one, pheniodide, 1282².
- C₁₃H₁₂NO₂ 1 - Naphthaleneglyoxylanilide, 2 - hydroxy-, 2046⁸.
- Oxyisoprotuberberine, 2,3 - methylenedioxy-, 2959¹.
- Oxyprotuberberine, 2,3 - methylenedioxy-, 2958⁸.
- C₁₃H₁₂NO₂ Isoquinoline, 6,7 - methylenedioxy-1 piperonyl-, 2671².
- C₁₃H₁₂NO₂ Anthraquinone, acetamidohydroxy-, benzoate, 2202⁴.
- Isoquinoline, 3,4 - dihydro- 6,7 - methylenedioxy - 1 - (3,4 - methylenedioxybenzoyl)-, and -H₁, 2671².
- Piperonyl alcohol, p - (6,7 - methylenedioxy - 1 - isoquinolyl)-, 2671².
- C₁₃H₁₂N₂O₂ Acetamide, N - (1,4 - dihydro - 1,4-diketo - 3 - N - nitrosoanilino - 2 - naphthyl)-, 2820⁸.
- C₁₃H₁₂N₂O 2,1,2 - Benzotriazole, 2 - (p - nitrosoanilinophenyl)-, 514¹, 515¹.
- C₁₃H₁₂N₂O 2,1,3 - Benzotriazole, 2 - (p - N-nitrosoanilinophenyl)-, 1 - oxide, 514¹.
- C₁₃H₁₂N₂O₂ Diphenylamine, p - (δ - nitrophenylazo) - N - nitroso-, 514¹.
- C₁₃H₁₂ Terphenyl, 2041¹.
- C₁₃H₁₂N₂O₂ Di(nitropyrrocatechol) - boric acid, aniline salt, 2178⁴.

- $C_{15}H_{11}BrNO_2$, Rhodanine, 5 - (5 - bromovanillin) - 3 - tolyl-, 2494¹.
- $C_{15}H_{11}Br_2ClO_2$, 1,4 - Butanedione, 2,3 - dibromo - 1,4 - bis(4 - chloro - *m* - tolyl)-, 1268¹.
- $C_{15}H_{11}ClNO_2$, 2, 3-Methylenedioxyprotoberberinium chloride, 995¹.
Naphtho - *m* - toluide, 5' - chloro - 6' - hydroxy-, 1562¹.
- $C_{15}H_{11}ClNO_2$, Isocarboxystyryl, 3 - chloro - 2 - homopiperonyl-, 2958¹.
- $C_{15}H_{11}ClNO_2$, Rhodanine, 5 - (5 - chlorovanillin) - 3 - tolyl-, 2494¹, 2495¹.
- $C_{15}H_{11}ClNO$, Glyoxylamide, α - chloro-, naphthylhydrazine, 43¹.
- $C_{15}H_{11}Cl_2O_2$, Δ^1 - 1,4 - Butenedione, 1,4 - bis(chloro-*m*-tolyl)-, 1269¹.
- $C_{15}H_{11}INO_2$, 2,3-Methylenedioxyprotoberberinium iodide, 2959¹.
- $C_{15}H_{11}INO_2$, Rhodanine, 5 - (5 - iodovanillin) - 3 - tolyl-, 2494¹, 2495¹.
- $C_{15}H_{11}N_2$, 3 - Indoleacrylonitrile, 2 - methyl - α - phenyl-, 505¹.
- $C_{15}H_{11}N_2O$ Compd., m. 149-50°, from the benzoate of α, γ - pentadienaldehyde and PhNHNH₂, 517¹.
7 - Perimidinol, 2 - methyl - 1 - phenyl-, and -HCl, 2337¹.
- $C_{15}H_{11}N_2O_2$, Acetophenone - *m* - azo - β - naphthol, 262¹.
Isoindigotin, 7,7' - dimethyl-, 1706¹.
2(1) - Naphthalenone, 1 - (*p* - acetamidophenylimino)-, 2487¹.
4,9 - $\beta\beta$ - Naphthimidazole, 2 - methyl-1-phenyl-, 2821¹.
1,4 - Naphthoquinonimine, 5 (and 6) - acetamido - *N* - phenyl-, 2337¹.
 $C_{15}H_{11}N_2O_2P_2S_2$ Compd., from *o* - phenylenediamine and PhOPSCl₂, 2326¹.
- $C_{15}H_{11}N_2O_2S$, 5 - γ - Isobenzophenothiazine, 9-dimethylamino - 6 - hydroxy-, 513¹.
- $C_{15}H_{11}N_2O_2$, Acetamide, *N* - (3 - anilino - 1,4-dihydro - 1,4 - diketo - 2 - naphthyl)-, 2820¹.
Acetanilide, *N* - (3 - amino - 1,4 - dihydro-1,4 - diketo - 2 - naphthyl)-, 2820¹.
Quinaldine, 8 - methoxy - α - (*m*-nitrobenzal)-, and salts, 266¹.
- $C_{15}H_{11}N_2O_2$, 2,5 - Piperazinedione, 1, 4 - dibenzoyl-, 995¹.
2,5 - Pyrazinediol, 3,6 - dihydro-, dibenzoate, 995¹.
- $C_{15}H_{11}N_2O_2$, Isoquinoline, 3,4 - dihydro - 6,7-methylenedioxy - 1 - (3,4 - methylenedioxybenzoyl)-, oxime, 2671¹.
- $C_{15}H_{11}N_2O_2S_2$, 5 - γ - Isobenzophenothiazine - 2-sulfonic acid, 9 - dimethylamino - 6 - hydroxy - 5 - keto-, K salt, 513¹.
Rhodanine, 5 - (5 - nitrovanillin) - 3 - tolyl-, 2494¹, 2495¹.
- $C_{15}H_{11}N_2O_2$, Anthraquinone, 1 - isopropyl - 4-methyl - γ, γ - dinitro-, 276¹.
- $C_{15}H_{11}N_2O_7$, Isatogen, 6 - nitro - 2 - phenyl-, Ac₂O addn. product, 646¹.
- $C_{15}H_{11}N_2O_8$, Isoindigotindisulfonic acid, 7,7'-dimethyl-, salts, 1706¹.
- $C_{15}H_{11}N_4$, 2,1,3 - Benzotriazole, 2 - (*p* - anilino-phenyl)-, and -HCl, 514¹.
- $C_{15}H_{11}N_4O$, 2,1,3 - Benzotriazole, 2 - (*p* - anilino-phenyl)-, 1 - oxide, and -HCl, 514¹.
- $C_{15}H_{11}N_4O$, 1 - Acenaphthenamine, 2 - (*p* - nitrophenylazo)-, 3668¹.
Diphenylamine, *p* - (*o* - nitrophenylazo)-, and -HCl, 514¹.
- $C_{15}H_{11}NO$, Acenaphthenamine, picrate, 651¹, 3268¹.
- $C_{15}H_{11}O$, Acetophenone, α - 1 - naphthyl-, 2820¹.
Ketone, benzyl naphthyl, 2820¹.
- $C_{15}H_{11}O_2$, 2 - Naphthol, 6 - methyl-, benzoate, 2819¹.
2,2'(1') - Spiro[indan - naphthalene] - 1,1'-dione, 3',4' - dihydro-, 61¹.
- $C_{15}H_{11}O_2$, γ - Hemitruanonic acid, 2826¹.
- $C_{15}H_{11}O_2$, Umbelliferone, 4 - methyl-, sulfate, 619¹.
- $C_{15}H_{11}O_2$, 1,2' - Bibenzofuran - 2(1) - one, 5,5'-dimethoxy-, 2047¹.
Chromone, 7 - hydroxy - 2 - methyl - 3-piperonyl-, 2653¹.
- $C_{15}H_{11}O_2$, Benzil, 2,4 - dihydroxy-, diacetate, 2046¹.
- $C_{15}H_{11}O_2$, 2 - Anthraquinonecarboxylic acid, 4,5,7 - trimethoxy-, and K salt, 1861¹.
- $C_{15}H_{11}BClNO_2$, Dipyrrocatecholboric acid, γ, γ' -chloroaniline salt, 2178¹.
- $C_{15}H_{11}BIN_2O_2$, Hydroxylamine, β - nitroso - β -phenyl-, Bi salt, 1232¹.
- $C_{15}H_{11}BrGeO_2$, Triphenylgermanium bromide, 3259¹.
- $C_{15}H_{11}BrNO_2$, 2 - Naphthol, (4-bromo-6-methyl - *m* - anisylazo)-, 2338¹.
- $C_{15}H_{11}CeN_2O_2$, Hydroxylamine, β - nitroso - β -phenyl-, Ce salts, 1233¹.
- $C_{15}H_{11}ClNO_2$, Naphthol, (4 - chloro - 2,5 - xylylazo)-, 255¹.
- $C_{15}H_{11}ClNO_2$, Oxazolidine, 3 - benzoyl - 2 - (benzoylimino) - 5 - (chloromethyl)-(?), 2052¹.
 Δ^1 - Oxazoline, 5 - chloromethyl - 2 - dibenzoylamino-(?), 2052¹.
- $C_{15}H_{11}ClNO_2S$, Naphtholsulfonic acid, (4-chloro-2,5 - xylylazo)-, 255¹.
- $C_{15}H_{11}ClNO_2S_2$, 3,6 - Naphthalenedisulfonic acid, 1,8 - dihydroxy - 2(4 - chloro - 2,5 - xylylazo)-, 255¹.
- $C_{15}H_{11}ClNO_2$, 2,3 - Diamino - 5 - phenylphenazonium perchlorate, 2330¹.
- $C_{15}H_{11}ClO_2$, 7 - Hydroxy - 2 - (*p* - hydroxystyryl)-4 - methylbenzopyrylium chloride, 1707¹.
- $C_{15}H_{11}ClO_2$, 4 - (3,4 - Dihydroxystyryl) - 7-hydroxy - 4 - methylbenzopyrylium chloride, 1707¹.
- $C_{15}H_{11}CoNO_2$, Hydroxylamine, β - nitroso - β -phenyl-, Co salts, 1233¹.
- $C_{15}H_{11}CrNO_2$, Hydroxylamine, β - nitroso - β -phenyl-, Cr salt, 1233¹.
- $C_{15}H_{11}IN_2O_2$, Urea, α - (4 - iodo - *o* - tolyl) - β -1 - naphthyl-, 2192¹.
- $C_{15}H_{11}InN_2O_2$, Hydroxylamine, β - nitroso - β -phenyl-, In salt, 1233¹.
- $C_{15}H_{11}NO$, Acetophenone, α - 1 - naphthyl-, oxime, 2820¹.
Benzamide, *N* - (methylnaphthyl)-, 2487¹, 4, 5.
Quinaldine, α - anisal-, salts, 1267¹, 1268¹.
Quinoline, methoxy - 2 - styryl-, and -HCl, 1279¹.
- $C_{15}H_{11}NO_2$, Carboxystyryl, 4 - (*p* - methoxystyryl)-, 1278¹.
Cinchophen, Et ester, -HI, P 75¹.
o - Cresol, α - (methoxy - 2 - quinolylmethyl-ene)-, 1279¹.
5,11 - Indenoquinoline, 6,7 - dimethoxy-, and -HCl, 2344¹.
Protoberberine, 2,3 - methylenedioxydihydro-, and salts, 2959¹.
Quinolmol, 2 - (methoxystyryl)-, and perchlorate, 1279¹.

- C₁₈H₁₅NO₂ Carbostryl, 4 - (3 - hydroxy - 4 - methoxystyryl)-, 1276¹.
- C₁₈H₁₅NO₂ Cinchoninic acid, phenyl-, β - hydroxyethyl ester, 3262⁴.
- Guaiacol, 1 - naphthylcarbamate, 3086⁴.
- β - Hemitrioxonic acid, oxime, 2826⁴.
- Oxydihydroisoprotuberberine, 2,3 - methylenedioxy-, 2959¹.
- Pyrocatechol, 4 - (7 - methoxy - 2 - quinolinyl - β - vinyl)-, and perchlorate, 1279⁴.
- C₁₈H₁₅NO₂S Rhodanine, 3 - *m* - tolyl - 5 - vanillal-, 2494⁴.
- C₁₈H₁₅NO₂ Isoquinoline, 3,4 - dihydro - 6,7 - methylenedioxy - α - piperonyl-, 2670¹.
- 1,3(2,4) - Isoquinolinedione, 2 - homopiperonyl-, 2058¹.
- Pentadienone, 1 - *p* - anisyl - 5 - (nitrophenyl)-, 1266^{1,3}, 1268².
- Quinoline, 2 - *p* - anisyl - 3 - methoxy - 6,7 - methylenedioxy-, 1141⁴.
- C₁₈H₁₅IO₃ 3 - Indalone, 2 - (nitroveratral)-, 2344^{4,7}.
- C₁₈H₁₅N₃O₄ 1,2,5 - Triazole - 3 - *o* - benzoic acid, 4 - carboxy - 1 - phenyl-, di-Me ester, 1865⁴.
- C₁₈H₁₅N₃O₄ 2,1,3 - Benzotriazole, 2 - [*p* - (*p* - aminoaniline)phenyl]-, 515¹.
- C₁₈H₁₅N₃O₄ 2,3 - Diamino - 5 - phenylphenazolum nitrate, 2330¹.
- C₁₈H₁₅N₃O₄Sb Hydroxylamine, β - nitroso - β - phenyl-, Sb salt, 1232¹.
- C₁₈H₁₅O₄P Phenyl phosphates, Ph₃PO₄, 2927⁴.
- C₁₈H₁₅Diindene, 492¹.
- Truxan, 493¹.
- C₁₈H₁₅AsNO₂ Cinchoninic acid, 2 - (*p* - arsonophenyl)-, Et ester, 1253¹.
- , 2 - (*p* - arsonophenyl) - 6 - methyl-, Me ester, 1256¹.
- C₁₈H₁₅BNO₄ Dipyrocatecholboric acid, aniline salt, 2178¹.
- C₁₈H₁₅BNO₄ Dipyrrogallolboric acid, aniline salt, 2178¹.
- C₁₈H₁₅Br₂ Diindene dibromide, 492¹.
- C₁₈H₁₅Br₂O Cyclopentanone, 2,3 - dibromo - 5 - methyl-, 3,4 - diphenyl-, 2934¹.
- C₁₈H₁₅Br₂O₂ 1,4 - Butanedione, 1,4 - bis(bromo-2,5-cresyl)-, 2046¹.
- , 2,3 - dibromo - 1,4 - di - 2,5 - cresyl-, 2046¹.
- Succinic acid, α , β - dibromo-, di - *p* - tolyl ester, 2046¹.
- C₁₈H₁₅Cl₂O₂ 1,4 - Butanedione, 2,3 - dichloro-1,4-ditolyl-, 1238¹.
- C₁₈H₁₅Cl₂O₂ 2 - *p* - Anisyl - 3 - chloro - 8 - ethoxybenzopyrylium chloride, FeCl₃ compd., 1707¹.
- Malonyl chloride, benzyl (β - ptenoxyethyl)-, 61¹.
- C₁₈H₁₅INO 3 - Hydroxy - 1 - methyl - 2 - styryl-quinolinium iodide, 1278¹.
- C₁₈H₁₅N₂ Adiponitrile, β - γ - diphenyl-(?), 485¹.
- o* - Phenylenediamine, *N*, *N'* - diphenyl-, 294¹.
- C₁₈H₁₅N₂O 2 - Pyrrolidone, 5 - γ -vino - 4 - methyl-1,5-diphenyl-, 503¹.
- C₁₈H₁₅N₂O Carbazole, 1,2,3,4 - tetrahydro-(?) - nitro - 9 - phenyl-, 521¹.
- C₁₈H₁₅N₂O Barbituric acid, 5 - phenethyl - 1 - phenyl-, 471¹.
- Northbenzene, cyano-, 2830¹.
- C₁₈H₁₅N₂O₂ 3 - Butine - 1,2 - α , β -dicarbasilic acid, 2472¹.
- 2 - Quinolinetanhol, 8- α -methoxy - α - [*m* (and *o*) nitrophenyl]-, and salts, 2668¹.
- C₁₈H₁₅N₂O₂ 4,4' - Bi - 1,3 - dioxolane, 2,2' - bis-(nitrophenyl)-, 2933¹.
- C₁₈H₁₅N₂O₂S Indonaphthol - 13 - thiosulfonic acid, 11 - dimethylamino - 2 - hydroxy-6 - sulfo-, *di-K salt*, 513¹.
- C₁₈H₁₅N₂ Dibenzocopyrine, 3,10 - α , α' -diamino-6,7 - dimethyl-, α , α' -HCl, 2955¹.
- Indazolophthorotriazine, 7,8,9,10 - tetrahydro - 10 - methyl-, 1263¹.
- C₁₈H₁₅N₂O₂ Oxeserolene, picrate, 2500¹.
- C₁₈H₁₅N₂ 1,2,3 - Triazole, 1,1' - *p* - biphenylenebis[5 - methyl-, 477¹.
- C₁₈H₁₅N₂O₂ 2 - Propanone, 1 - (2,4 - dinitrophenyl)-, azine, 2938¹.
- C₁₈H₁₅N₂S₂ 1,3,4 - Thiodiazole, 2,2' - dithio-bis[4,5 - dihydro - 5 - *p* - tolylimidazole-, 988¹.
- C₁₈H₁₅O₂ Δ^2 - Cyclopentenone, 5 - methyl - 3,4 - diphenyl-, 2934¹.
- C₁₈H₁₅O₂ Anthraquinone, diethyl-, 2950¹.
- , 1 - isopropyl - 4 - methyl-, 276¹.
- 1(2) - Benzofuranone, 2 - allyl - 4 - methyl-2-phenyl-, 1277¹.
- C₁₈H₁₅O₂S₂ 2 - Naphthalenesulfonic acid, thiol-, 2,4-xylyl ester, 3259¹.
- C₁₈H₁₅O₂ Δ^2 - 1,4 - Butenedione, 2 - ethoxy-1,4 - diphenyl-, 1268¹.
- o* - Toluic acid, α - (1,2,3,4 - tetrahydronaphthalen-1 - keto - 2 - naphthyl)-, 61¹.
- C₁₈H₁₅O₂S₂ 2-Naphthalenesulfonic acid, thiol, 5-methyl-*o*-anisyl ester, 3259¹.
- C₁₈H₁₅O₂ Chalcone, hydroxymethoxy-, acetate, 982¹, 1414¹.
- Cinnamic acid, 3,4 - methylenedioxy - α - phenyl-, Et ester, 2480¹.
- Compd. from 2-methyl - 5 - benzofuranol, and perchlorate, 2665^{1,4}.
- α , α' -Stilbenediol, diacetate, SmCl₃ addn. compd., 50¹.
- γ -Truxinic acid, 2825¹.
- C₁₈H₁₅O₂ 2(3),9' - Sprio[furan - xanthen] - 5(4)-one, 3',6'-dihydroxy-4,4-dimethyl-, 986¹.
- C₁₈H₁₅O₂ Benzoic acid, *p*-hydroxy-, *p*-acetoxybenzoate, Et ester, 1417¹.
- 2,5-Cresotic acid, 2,5-cresotate, acetate, 521¹.
- C₁₈H₁₅O₂ Compd. from C₂O₂ and PrOH, 40¹.
- C₁₈H₁₅BrO₂ Chalcone, α -bromo- β -propoxy-, 43¹.
- C₁₈H₁₅BrO₂ 2 - *p* - Anisyl - 8 - ethoxy - 3 - hydroxybenzopyrylium bromide, 520¹.
- C₁₈H₁₅BrNO₂ Codeinone, dibromohydroxy-, and HBr, 298^{1,4}.
- C₁₈H₁₅ClO₂ Dimethoxymethylphenylbenzopyrylium chloride, and FeCl₃ compd., 517¹, 1707^{1,4}.
- C₁₈H₁₅ClO₂ 2 - *p* - Anisyl - 8 - ethoxy - 3 - hydroxybenzopyrylium chloride, 520¹.
- C₁₈H₁₅ClO₂ 2 - (Dimethoxyphenyl)dihydroxy - 3 - methoxybenzopyrylium chloride, 2342¹.
- C₁₈H₁₅ClO₂ 2 - (2,4 - Dimethoxyphenyl) - 5,6-dihydroxy - 3 - methoxybenzopyrylium perchlorate, 2342¹.
- C₁₈H₁₅HgNO₂ Pyrrole, 2,3,4,5 - tetrakis(hydroxymethyl) - 1 - phenyl-, tetraacetate, 2263¹.
- C₁₈H₁₅N Carbazole, 1,2,3,4 - tetrahydro - 9 - phenyl-, 521¹.
- C₁₈H₁₅N *p*-Anisidine, *N*-(*o*-phenyl)- Δ^1 - Δ^2 -penta-dienylidene-, 2941¹.
- 1-Naphthalenesarbinol, α -(aminomethyl)- α -phenyl-, and salts, 2820¹.
- Δ^2 -Pyrroline, 1-acetyl-2,4-diphenyl-, 2822¹.
- C₁₈H₁₅NO₂ Δ^2 - 1,4 - Butenedione, 2 - amino-1,4-ditolyl-, 1268¹.

- Isoprotoberberine, 2,3 - methylenedioxy-tetrahydro-, and -HCl, 2959¹.
 3 - Pentadienone, 1 - (aminophenyl) - 5 - *p*-anisyl-, and salts, 1266¹, 1268¹.
 Protoberberine, 2,3 - methylenedioxytetrahydro-, and salts, 2958¹.
 2 - Quinolincethanol, 7 - methoxy - α - phenyl-, and salts, 1279¹.
 J₁, H₁₇NO₂ Chalcone, 3-acetamido-4'-methoxy-, 1266¹.
 2 - Quinolincethanol, 7 - methoxy - α - salicyl-, 1279¹.
 4 - Quinolinal, 2 - (β - hydroxy - *p* - methoxyphenethyl)-, 1279¹.
 1 - Truxinamic acid, 2826¹.
 J₁, H₁₇NO₂ Diacetanilide, 2-hydroxy - 5 - phenyl-, acetate, 1858¹.
 Isoquinoline, 1,2,3,4 - tetrahydro - 6,7 - methylenedioxy - 1 - piperonyl-, and -HCl, 2670¹.
 9 - Phenanthrol, 9,10 - dihydro - 2,3(or 3,4) - methylenedioxy-, urethan, 499¹.
 Propylamine, γ -(3,4-methylenedioxyphenyl)-*N*-piperonylidene-, 2652¹.
 Δ^1 -Pyrroline, 2,4-diphenyl-, acid oxalate, 2822¹.
 C₁₈H₁₇NO₂ Glutamic acid, *N*-benzoyl- β -phenyl-, 2203¹.
o - Toluic acid, α - (*N* - homopiperonylcarbamyl)-, 2958¹.
 C₁₈H₁₇NO₂ 2 - Naphthaleneacetic acid, 3 - acetamido - α - acetyl - 1,4 - dihydro - 1,4 - diketo-, Et ester, 2822¹.
 Toluic acid, α -dimethoxybenzalnitro-, Me ester, 1419¹, 1420¹.
 --, 3-nitro- α -eratrul-, Me ester, 1420².
 C₁₈H₁₇N₂O₂ Phosphate dianilide, Ph ester, 2325¹.
 C₁₈H₁₇N₂ Ketone, benzyl 2-pyrryl, phenylhydrazine, 2492¹.
 C₁₈H₁₇N₂O₂ Pyrazole, 3,5-dimethyl-4-(3-nitro-*p*-tolylazo)-1-phenyl-, 3090¹.
 C₁₈H₁₇ Diindene, dihydro-, 492¹.
 Retene, 2306¹, 2334¹.
 C₁₈H₁₇AlCl₂Cl₂NO₂, 942¹.
 C₁₈H₁₇BrNO₂ + H₂O, 2310¹.
 C₁₈H₁₇BrNO₂ Codeinone, bromo-, 297¹, 2828¹.
 C₁₈H₁₇BrNO₂ Codeinone, bromohydroxy-, and -HBr, 298¹.
 C₁₈H₁₇BrNO₂ Codeinone, tribromodihydroxy-, and -HBr, 298¹.
 C₁₈H₁₇Br₂NO₂ Galactose, (dibromophenyl)osazone, 44¹.
d-Glucose, (dibromophenyl)osazone, 44¹.
 G₁, H₁₇Cl₂NO₂ *p*-Glucose, 5,6-dichlorohydrin, *p*-nitrophenylosazone, 2480¹.
 C₁₈H₁₇N₂ Azetodindole, 5,10,10,11 - tetrahydro-10,11-dimethyl-, and -HCl, 65¹.
 C₁₈H₁₇N₂O₂ Benzothiazole, 1 - (6 - acetamidom-tolyl)-3,5-dimethyl-, 1412¹.
 C₁₈H₁₇N₂O₂ 2(1)-Benzofuranone, 1 - (*p* - dimethylaminophenylimino) - 3,5 - dimethyl-, 2046¹.
 2,5-Piperazinedione, 1,4-dibenzyl-, 995¹.
 Pyrazine, 2,5 - bis(benzyl)- - 3,6 - dihydro-, 831¹, 995¹.
 Δ^1 - Pyrazoline, 1 - acetyl - 3(or 5) - anisyl-5(or 3)-phenyl-, 283¹.
 C₁₈H₁₇NO₂ S₁(4s) Carbazolol, 5,6,7,8 - tetrahydro - 4 - nitro - 9 - phenyl-, 521¹.
 3 - Isophenoxazone, 4 - acetamido - 2,5,7,10-tetramethyl-, 2340¹.
 Δ^1 - Pyrazoline, 5 - carboxy - 1,3 - diphenyl-(?), Et ester, 2049¹.
 C₁₈H₁₇N₂O₂ Naphthalenesulfonic acid, γ -benzylthiopseudourate salt, 495¹.
 C₁₈H₁₇N₂O₂ Homophthalamide, *N*' - homopiperonyl-, 2958¹.
 Succinic acid, α -phenacyl-, phenylhydrazine, 246¹.
p-Toluic acid, α -(*p*-dimethylaminobenzal)-3-nitro-, Me ester, 1420².
 C₁₈H₁₇N₂O₂ Benzoic acid, azoxybis-, di-Et ester, 1072¹, 1640¹.
 3 - Pyrrolidineacetic acid, 3 - hydroxy - 2,5-diketo-1-phenyl-, PhNH₂ salt, 3255¹.
 C₁₈H₁₇N₂O₂ Nicotinic acid, 5-acetyl-1,6-dihydro-6 - keto - 1,2 - dimethyl - 4 - (*m* - nitrophenyl)-, Et ester, 2497¹.
 C₁₈H₁₇N₂O₂ Oxindole, 3-(6-aminopiperonylidene)-, methosulfate, 2956¹.
 C₁₈H₁₇N₂O₂ Addn. compd., m. 194-5°, of 2,5-piperazinedione and salicylic acid, 2033¹.
 C₁₈H₁₇N₂ Pyrazole, 3,5-diphenyl-1-phenyl-*p*-tolylazo-, 3090¹.
 C₁₈H₁₇N₂O Indazole, 4,5,6,7 - tetrahydro - 3 - (2 - hydroxy - 1 - naphthylazo) - 7 - methyl-, 1263¹.
 C₁₈H₁₇N₂O₂ Oxalic acid, bis(α -methylbenzylhydrazide), 2327¹.
 C₁₈H₁₇N₂O₂ Compd. from 3-(3-nitro-*p*-tolylazo)-2,4-pentanedione and PhNH₂, m. 138°, 3090¹.
 C₁₈H₁₇N₂O₂ Pyruvic acid, α , α' -(*p*,*p'*-biphenylene)bis-hydrazine, 3259¹.
 C₁₈H₁₇N₂O₂ Isoquinoline, ethoxy-3,4-dihydro-methoxy-, picrates, 2959¹.
 C₁₈H₁₇N₂O₂ Benzothiazole, 1,1'-dithiobis[5-dimethylamino-], 513¹.
 C₁₈H₁₇N₂O₂ Isobutyric acid, β , β' -diformyl-, bis(*p*-nitrophenylhydrazine), 1129¹.
 C₁₈H₁₇N₂O₂ 2,3-Butanediamine, *N*, *N'*-dinitro-*N*, *N'*-bis(2,6-dinitro-*p*-tolyl)-, 984¹.
 C₁₈H₁₇O₂ Benzoic acid, *g*-(isopropyltolyl)-, and Ag salt, 276¹.
 Chalcone, 4-ethoxy-3-methoxy-, 3064¹.
 Thebenol, dihydromethoxy-, 2829¹.
 C₁₈H₁₇O₂ 1,4-Butanedione, 1,4-di-2,6-cresyl-, 2046¹.
 Chalcone, trimethoxy-, 982¹, 1419¹.
 Isozingerone, benzoate, 2944¹.
 Malonic acid, benzylphenethyl-, 61¹.
 Succinic acid, di-*p*-tolyl ester, 2046¹.
 C₁₈H₁₇O₂ Ethanol, 2,2'-dithiobis-, dibenzoate, 1557¹.
 C₁₈H₁₇O₂ Anthrone, 1,2,6,7 - tetramethoxy-, 2491¹.
 2,5-Cresotic acid, Et ester, 2,5-cresotate, 521¹.
 Ethanol, 2,2'-oxybis-, dibenzoate, 634¹.
 Malonic acid, benzyl(β -phenoxyethyl)-, 61¹.
 Phthalide, 2 - (3,5 - dimethylsalicyl) - 5,6 - dimethoxy-, 2490¹.
 C₁₈H₁₇O₂ *o*-Veratric acid, 6-(3-methylanisoyl)-, 653¹.
 C₁₈H₁₇O₂ 3,6-Benzofurandione, 1,2-dihydro-4-(α -hydroxyveratryl)-5-methoxy-, 484¹.
 C₁₈H₁₇BrO₂ Propiophenone, α -bromo-2,4,6-trimethoxy- β -phenyl-, 1260¹.
 C₁₈H₁₇ClO₂ Acetyl chloride, bis(β - phenoxyethyl)-, 62¹.
 C₁₈H₁₇IN₂ 4 - (*N* - Methylanilino) - 1,2 - dimethylquinonium iodide, 1279¹.
 C₁₈H₁₇N₂ Diandarylarine, 1520¹.
 C₁₈H₁₇NO₂ Apophenemethine, 2500¹.
 Chalcone, 4-dimethylamino - 4' - methoxy-, 1265¹; and salts, 1266¹.

- Hydrohydrastinine, benzyl-, and -HCl, 2959².
- Phenol, *o*-(α -methyl- Δ^2 -butenyl)-, carbani-
lone, 2038⁷.
- C₁₃H₁₁N₃O₂ Caproic acid, *o*-(*o*-anilinophenyl)-*o*-
keto, 521⁴.
- 9-Phenanthrol, 9,10-dihydro-3-methoxy-,
urethan, 499³.
- 3-Toluic acid, Δ -(*N*-phenethylcarbonyl)-,
2958².
- C₁₃H₁₁NO₂S Aniline, *N*, *N*-dimethyl, naphthal-
enesulfonate, 650².
- Xylidine, naphthalenesulfonate, 650².
- C₁₃H₁₁NO₂ Carbamic acid, benzylhydroxy-, Pr
ester, benzoate, 966².
- Codeinone, hydroxy-, 297⁴, 299⁴.
- Nicotinic acid, 5-acetyl-1,6-dihydro-6-keto-
1,2-dimethyl-4-phenyl-, Et ester, 2497².
- C₁₃H₁₁NO₂S Phenetidine, naphthalenesulfonate,
650².
- C₁₃H₁₁NO₂ Codeinone, dihydroxy-, 297⁴.
- o*-Toluic acid, α -(*N*-homopiperonylcar-
bonyl)-, Me ester, 2958².
- C₁₃H₁₁NO₂S Codeinonesulfonic acid, hydroxy-,
298².
- C₁₃H₁₁N₂O₂PS Thiophosphate dianilide, Ph
ester, and *Na* salt, 2325⁴.
- C₁₃H₁₁N₂ Compd., m. 268², from 4-chloro-
quinoline and *as*-dimethylphenylenedi-
amine, and -HCl, 1279².
- Indoline, 1,3,3-trimethyl-2-phenylazo
methylene-, and -H₂, 64².
- C₁₃H₁₁N₂O₂ 2-Butanone, 4-(*m*-hydroxyphenyl)-,
benzoate, semicarbazone, 2944⁴.
- Indoloquinoxaline, 2,3-dimethoxy-10-
methyl-, methohydroxide, and isomer,
2957¹.
- C₁₃H₁₁N₂O₂ Citric acid, phenylhydrazide anilide,
3255².
- Compd. from goose feathers, 1869⁴.
- C₁₃H₁₁N₂O₂S Indole, uinoxaline, 2,3-dimethoxy-,
methosulfate, 2956².
- C₁₃H₁₁N₂O₂ Phenazine, octahydro-, picrate,
2499².
- C₁₃H₁₁N₂O₂S Δ^2 -Thiazoline, 2-anilino-5-ethoxy-
4-methyl-, picrate, 1710¹.
- , 5-methyl-2-phenetidinone-, picrate, 57⁴.
- C₁₃H₁₁BrNO₂ Codeine, bromo-, 2828⁴.
- C₁₃H₁₁BrNO₂ Codeinone, bromodihydrohydroxy-,
and -HBr, 297⁴, 298⁴.
- C₁₃H₁₁BrNO₂ Codeinone, bromodihydrotrihy-
droxy-, 298⁴.
- C₁₃H₁₁ClNO₂ Codeine, α (and β)-chloro-, 2828⁴.
- C₁₃H₁₁ClNO₂ Codeine, chloro-, 2828⁴.
- C₁₃H₁₁ClN₂O₂ *d*-Glucose, 5,6-dichlorohydrin,
phenylosazone, 2480².
- C₁₃H₁₁CuN₂O₂, 2173².
- C₁₃H₁₁IN₂ Addn. compd. of benzdiazole and 1-
methylpyridinium iodide, 2053².
- C₁₃H₁₁N₂O₂ Addn. compd. of hydroquinol
and 1,1'-dimethyl-4,4'-bipyridinium di-
iodide, 2653².
- C₁₃H₁₁N₂O₂ 2-Furandehyde, tetrahydro-, benzyl-
phenylhydrazone, 27².
- C₁₃H₁₁N₂O₂ Benzamide, *N*, *N*'-2,3-butylenebis-,
204⁴.
- Glutaranilide, α -methyl-, 2477².
- Hydrazine, isobutyl-, di-Bz deriv., 3478².
- Pyruvic acid, phenyl-, Et ester, *p*-tolyl-
hydrazon, 3261².
- C₁₃H₁₁N₂O₂S Acetazolid, *o*, *o*'-difluorobis[*N*-
methyl-, 2339⁴.
- C₁₃H₁₁N₂O₂ Malonamide, α -benzyl- α -(β -phenoxy-
ethyl)-, 61².
- C₁₃H₁₁N₂O₂S Disulfoxide, bis (4-acetamido-*p*-
tolyl), 476¹.
- C₁₃H₁₁N₂O₂ Benzamide, *N*-(4-ethoxy-3-
methoxyphenyl)-*m*-nitro-, 2959².
- C₁₃H₁₁N₂O₂ 3,4-Pyrolidicarboxylic acid, 2,5-
dimethyl-1-(*p*-nitrophenyl)-, di-Et ester,
279¹.
- C₁₃H₁₁N₂O₂S Phenylenediamine, benzenesul-
fonate, 651².
- C₁₃H₁₁N₂S Thiazolidine, 2-(*p*-tolylimino)-3-
xyl-yl-, 2481².
- , 3-*p*-tolyl-2-(2,5-xylimino)-, 2481².
- C₁₃H₁₁N₂O₂ 2,4-Pentanedione, 3-*p*-tolylazo-,
phenylhydrazon, 3090².
- C₁₃H₁₁N₂O₂ Addn. compd., m. 183-4°, of
anthranilic acid and 2,5-piperazinedione,
2033².
- C₁₃H₁₁N₂O₂ Uracil, 1,3-dimethyl-5,6-bis(phenyl-
hydrazino)-, 2055².
- C₁₃H₁₁N₂O₂ 2,3-Butanediamine, *N*, *N*'-bis-
(2,6-dinitro-*p*-tolyl)-, 984⁴.
- C₁₃H₁₁O₂ Anisole, *p*, *p*'- Δ^1 -butenyldienebis-, 266².
- Diphenoquinone, 5,3'(or 5,5')-diethyl-3,5'(or
3,3')-dimethyl-, 270².
- C₁₃H₁₁O₂ Camphor, 3-piperonylidene-, 2653².
- Guaiacol, 4-butyl-, benzoate, 2943⁷.
- C₁₃H₁₁O₂ Propiophenone, *p*-methoxy- β -(2,3-di-
methoxyphenyl)-, 982⁴.
- C₁₃H₁₁O₂ Camphor, hydroxy-, acid phthalate,
3267².
- C₁₃H₁₁O₂ Melilotic acid, α -acetyl- α - β 'yl- β -keto-,
Et ester, acetate, 466².
- Phloreotic acid, α -acetyl- α -allyl- β -keto-, Et
ester, acetate, 166².
- o*-Veratric acid, 6-veratyl-, 2491¹.
- C₁₃H₁₁O₂ 3,6-Benzofurandiol, 1,2-dihydro-4-(α -
hydroxyveratryl)-5-methoxy-, 484².
- C₁₃H₁₁BrO₂ Δ^2 1,1,3-Propenetricarboxylic acid,
1(or 3) bromo-2-phenyl-, tri-Et ester,
2643².
- C₁₃H₁₁ClN₂O₂ 4,5'-Bipyrrole-3-carboxylic acid,
5-chloroacetyl-4'-hydroxy-2,2'-di-
methyl-, di-Et ester, 75².
- C₁₃H₁₁N Piperidine, 1-benzylhydrazyl-, and -HCl,
519².
- C₁₃H₁₁N *p*-Curcumotoluide, 277².
- α -Toluo-*p*-toluide, α -ethyl-*p*-methyl-, 277².
- C₁₃H₁₁N₂O Aniline, *N*-benzyl-4,5-dimethoxy-2-
propyl-, -HCl, 2474².
- C₁₃H₁₁NO₂ (See also Codeine.)
- Acetamide, α , α -bis(β -phenoxyethyl)-, 62¹.
- Allopseudocodeine, 2828².
- Aniline, 4,5-dimethoxy-2-propyl-*N* salicylal,
and -HCl, 2474².
- Base from bromocodeinone, 2429².
- Benzamide, *N*-(ethoxymethoxyphenethyl)-,
2959².
- Ether, ethyl (β -nitro- α , α -di-*p*-tolylethyl),
491⁷.
- Isocodeine, 2828².
- Pseudocodeine, 2828².
- Thebenine, dihydro-, and salts, 2829².
- C₁₃H₁₁N₂O Benzamide, *N*-methyl-*N*-(3,4,5-tri-
methoxybenzyl)-, 2652².
- , *N*-(3,4,5-trimethoxy- α -methyl-
benzyl)-, 2652².
- Codeinone, dihydrohydroxy-, 299⁴.
- Propiophenone, *p*-methoxy- β , β '-2,3-dimethoxy-
phenyl-, oxime, 982⁴.
- C₁₃H₁₁N₂O₂ Difluorobis(4-furyl-1,2-dihydro-
1,6-dimethyl-2-methylene-, di-Et ester,
and perchlorate, 2497¹.
- C₁₃H₁₁NO₂ Codeinone, dihydrotrihydroxy-, 298⁴.
- C₁₃H₁₁NO₂ Peroxide from di-Et (4-furyl-1,2-

- dihydro-1,6-dimethyl-2-methylenedinitro-
tinate and O, 2497⁷.
- C₁₁H₁₃N₃O₅ Acetophenone, *p*-methoxy- α -(*p*-methoxybenzyl)-, semicarbazone, 58⁸.
- Codeinone, hydroxy-, hydrazone, 299^{1,2}.
- Nicotinic acid, 5-acetyl-1,6-dihydro-6-keto-
1,2-dimethyl-, Et ester, phenylhydrazone,
2497⁷.
- C₁₁H₁₃N₃O₅ Pilocarpine, 2,4,6-*m*-cresol salt,
2052⁹.
- C₁₁H₁₃ 1,7-Decadien-9-ine, 2,6-dimethyl-
10-phenyl-, 1417⁷.
- C₁₀H₁₂BrN₂O Codeine, bromodihydro-, 2828⁸.
- C₁₁H₁₃BrN₂O₂ Compd. from goose feathers,
1869⁹.
- C₁₁H₁₃ClNO Codeine, chlorodihydro-, 2828⁸.
- C₁₁H₁₃N₂O Butyrophenone, *p*-methoxy-, phenyl-
hydrazone, 266⁹.
- Enanthaldehyde, α -2-fural-, phenylhydra-
zone, 1139².
- C₁₁H₁₃N₂OS Carbanilide, α -(β -hydroxyethyl)-
trimethylthio-, 2481³.
- C₁₁H₁₃N₂O₂ (See also *Holocaine*.)
- 4-Isopyrrolecarboxylic acid, 3,5-dimethyl-2-
(β -dimethylaminobenzal)-, Et ester, *per*-
chlorate, 2823⁸.
- Piperazine, 2,5-bis-*p*-hydroxybenzyl-, 80¹.
- β -Quinonimine, 2-amino-*N*-(6-hydroxy-*s*-
pseudocumyl)-3,5,6-trimethyl-,
2340².
- C₁₁H₁₃N₂O₂ Caproic acid, ϵ -amino- α -4-quinolyl-
furyl-, Et ester, 659⁹.
- Codeinone ketimine, dihydrohydroxy-, 299².
- Oxime, decomps. 266-70°, of base from
bromocodeinone, 2829⁸.
- C₁₁H₁₃N₂O₄ 3-Pyrroledicarboxylic acid, 1(*p*-
aminophenyl)-2,5-dimethyl-, di-Et ester,
270¹.
- C₁₁H₁₃N₂O₄ 4,5'-Bipyrrole-3-carboxylic acid, 4'-
hydroxy-2,2'-dimethyl-, di-Et ester, acce-
tate, 75².
- C₁₁H₁₃N₂O₄ 2,3-Butanediamine, *N*, *N'*-bis(nitro-
p-tolyl)-, 984³.
- C₁₁H₁₃N₂O₅ Phenethylamine, 3-ethoxy-4-methoxy-,
trinitro-*m*-cresolate, 2959⁸.
- C₁₁H₁₃N₂S₂ Formamidine, *C*,*C'*-ethylenedithio-
bis[*N*-methyl-*N'*-phenyl-, and -*HBr*,
2481³.
- C₁₁H₁₃Cl 4,4'-Bi-*o*-cresol, 6,6'-diethyl-, 270⁹.
- Camphor, 3-anisal-, 2655².
- Isobutyraldehyde, dibenzyl acetal, 2474².
- C₁₁H₁₃O₂ Camphor, 3-piperonyl-, 2655².
- C₁₁H₁₃O₄ Camphenilol, β -methyl-, acid phtha-
late, 2946¹.
- Fenchyl alcohol, acid phthalate, 2656⁹,
2657².
- α -Ferneol, acid phthalate, 486⁸.
- C₁₁H₁₃O₄ 1,1,2-Cyclopropanetricarboxylic acid,
3-phenyl-, tri-Et ester, 2643².
- C₁₁H₁₃S₂ Sulfide, bis(β -benzylmercaptoethyl),
1557⁹.
- C₁₁H₁₃S₂ Disulfide, bis(β -benzylmercaptoethyl),
1557⁹.
- C₁₁H₁₃BrO₂ α -Toluic acid, α -bromo-, bornyl
ester, 2484⁸, 2485¹.
- C₁₁H₁₃ClO₂ α -Toluic acid, α -chloro-, bornyl ester,
2484⁸, 2485¹.
- C₁₁H₁₃NO Fupyrrole, 1,1,3,3,4,6-hexamethyl-
5-phenyl-, 502².
- C₁₁H₁₃NO₂ Compd. from codeinone, 297².
- 1-Hexanol, methyl-, naphthylurethan, 463⁹,
464².
- C₁₁H₁₃NO₂ Benzyl alcohol, α -(4,5-dimethoxy-2-
propylanilino)-, and -*HCl*, 2474⁸.
- Codeine, dihydro-, 2828⁸.
- C₁₁H₁₃NO₂ Dinicotinic acid, 4-furyl-1,2(and 1,4)-
dihydro-1,2,6-trimethyl-, di-Et ester,
2497⁷.
- C₁₁H₁₃N₂ Propiophenone, *p*-dimethylamino-,
phenylhydrazone, 267⁸.
- C₁₁H₁₃N₂O Codeinone, dihydrohydroxy-, hy-
drazone, 299^{1,2}.
- C₁₁H₁₃N₂O₂ Oxazolidone, 2-di-*p*-tolylsulfonfyl-
amino-2-methylamino-, 2052⁹.
- C₁₁H₁₃ 1,3,9-Decatriene, 5,9-dimethyl-1-
phenyl-, 1417⁷.
- Triphenylene, dodecahydro-, 1270⁸.
- C₁₁H₁₃BeCl₂N₂ 3071².
- C₁₁H₁₃N₂O Urea, α -(γ -methylhexyl)- β -naphthyl-,
464².
- C₁₁H₁₃N₂O₂ 1-Propanesulfonic acid, 1-(*p*-tolyl
carbamyl)-, *p*-toluidine salt, 37⁷.
- C₁₁H₁₃N₂O₂ *p*-Toluenesulfonamide, *N*, *N'*-2,3-
butylenebis-, 984³.
- , *N*, *N'*-ethylenebis[*N*-methyl-, 67⁴.
- C₁₁H₁₃N₂O₂ 1-Propanesulfonic acid, 1-(*p*-
anisylcarbamyl)-, *p*-anisidine salt, 37⁷.
- C₁₁H₁₃N₂O₂ Alanine, *N*-(*N*,*O*-dicarbomethoxy-
tyrosyl)-, Et ester, 1248⁸.
- C₁₁H₁₃N₂S₂ Benzylamine, *N*, *N'*-dithiodi-
methylenebis[*N*-methyl-, and -*HCl*, 238¹.
- C₁₁H₁₃N₂O 3,3'-Biindazole, 2-acetyl-4,5,6,7,
4',5',6',7'-octahydro-7,7'-dimethyl-,
1263³.
- C₁₁H₁₃O 9-Decen-1-in-3-ol, 5,9-dimethyl
1-phenyl-, 1417⁷.
- Menthone, 2-*p*-methylbenzal-, 2042².
- C₁₁H₁₃O₂ Camphor, 3-methoxybenzyl-, 2655².
- C₁₁H₁₃O₂ Ammorensinol, 2261⁹.
- 3-Camphorylideneacetic acid, 3-methyl-1-
pentin-3-ol ester, 1418⁸.
- C₁₁H₁₃O₄ Hydrocinnamic acid, α -acetyl- α -iso-
valeryl-, Et ester, 466⁸.
- C₁₁H₁₃BrO₂ α -Toluic acid, α -bromo-, menthy
ester, 2485¹.
- C₁₁H₁₃ClO Menthone, 2-(α -chloro-*p*-methylben-
zyl)-, 2042².
- C₁₁H₁₃ClO₂ α -Toluic acid, α -chloro-, menthyl
ester, 2484⁸.
- C₁₁H₁₃N θ -Decenonitrile, δ , θ -dimethyl- α -
phenyl-, 2030².
- C₁₁H₁₃NO₂ α -Toluic acid, α -amino-, camphor
sulfonate, 1415⁷.
- C₁₁H₁₃N₂O Camphor, 4-*p*-tolylsemicarbazone,
478⁸.
- C₁₁H₁₃BrNO₂ Aniline, *N*-ethyl-, α - π - α -bromo
camphorsulfonate, 510⁹.
- Compd., m. 195-6°, from *N*-ethylaniline
and *d*- π - α -bromocamphorsulfonic acid,
511⁹.
- C₁₁H₁₃Y₂O₂ Malonic acid, acetonylethyl-, di-E
ester, phenylhydrazone, 3480⁸.
- , acetonylisobutyl-, mono-Et ester, phenyl
hydrazone, 3480⁸.
- C₁₁H₁₃N₂ 3,3'-Biindazole, 4,5,6,7,4',5',6',7'
octahydro-7,7',7',7'-tetramethyl-, 1263³.
- C₁₁H₁₃N₂O Indole, 1-butylperhydro-, picrate,
1862².
- C₁₁H₁₃O₂ θ -Decenic acid, δ , θ -dimethyl- α -phenyl-,
2030².
- C₁₁H₁₃O₂ 3-Camphaneacetic acid, 2-keto-, 3-
methyl-1-pentin-3-ol ester, 1418⁸.
- 3-Camphorylideneacetic acid, 3-methyl- Δ -3-
pentinol ester, 1418⁸.
- Mandelic acid, menthyl ester, 2485⁹.
- C₁₁H₁₃NO Acetanilide, *N*-(3,7-dimethyl- Δ -oc-
tenyl)-, 2029⁸.

- C₁₈H₂₇NO₂ Menthone, 2 - (α -hydroxamino - *p*-methylbenzyl)-, 2042^a.
- C₁₈H₂₇NO₂ Sebaccanic acid, *Et* ester, 1128¹.
- C₁₈H₂₇NO₂, Dinicotinic acid, 1,2-dihydro-4-isobutyl-, 6-dimethyl-2-methylene-, di-*Et* ester, *add perchlorate*, 2497¹.
- C₁₈H₂₇N₃O Benzaldehyde, 4-menthylsemicarbazone, 1130¹.
- C₁₈H₂₇N₃O⁺ 1-Hendecene, 2-methyl-1-phenyl-, 2475¹.
- C₁₈H₂₇Cl₂MnN₃, 1385¹.
- C₁₈H₂₇Cl₂MnN₃, 1385¹.
- C₁₈H₂₇O Menthol, 2-*p*-methylbenzyl-, 2042^a.
- C₁₈H₂₇O₂ 3-Camphaneacetic acid, 2-keto-, 3-methyl- Δ^1 -3-pentanol ester, 1418¹.
- 3-Camphorylideneacetic acid, 3-methyl-3-pentanol ester, 1418¹.
- C₁₈H₂₇O₂ Pelargonaldehyde, θ -hydroxy-, di-Me acetal, benzoate, 468¹.
- C₁₈H₂₇NO₄ Dinicotinic acid, 1,2-dihydro-4-isobutyl - 1,2,6 - trimethyl-, di-*Et* ester, 2497¹.
- C₁₈H₂₇ Benzene, *heptyl*-, 11¹.
- C₁₈H₂₇Cl₂N₂O₂W₂, 618¹.
- C₁₈H₂₇Cl₂NO₂ 3,5-Heptanedione, 2,6-dimethyl-, Cu deriv., 2027¹.
- C₁₈H₂₇N₂O₂ Berzoic acid, *p*-amino-, γ -di-*sec*-butylaminopropyl ester, P 153^a.
- C₁₈H₂₇O Anacardol, 3607¹.
- 2-Hendecanol, 2-methyl-1-phenyl-, 2475¹.
- Linoleic anhydride, 2637¹.
- C₁₈H₂₇O₂ Eicosic acid, 2475¹.
- Linolenic acid, 307¹, 2419¹.
- C₁₈H₂₇O₂ 3-Camphaneacetic acid, 2-keto-, 3-methyl-3-pentanol ester, 1418¹.
- C₁₈H₂₇O₂ Glucosidoglucoisodiglucoiside, 975¹.
- Trihexosan, 976¹.
- C₁₈H₂₇Cl₂ 2272¹.
- C₁₈H₂₇NO₂ Oxazole, 5-ethoxy-4-isobutyl-2-(1,2,3,4-tetramethylcyclopentyl)-, 2052¹.
- C₁₈H₂₇O₂ 2272¹.
- C₁₈H₂₇Br₂O₂ Stearic acid, dibromodiiodo-, 2637¹.
- C₁₈H₂₇O₂ Chaulmoogric acid, 2476¹.
- Compd. from chaulmoogra oil, 2930¹.
- Fenchylalcohol, caprylate, 2657¹.
- Linoleic acid, 2326¹, 2637¹; *salts*, 1406¹.
- C₁₈H₂₇O₂ Glucosidoglucoisodiglucoiside, 975¹.
- C₁₈H₂₇NO₂ Leucine, *N*-campholyl-, *Et* ester, 2052¹.
- C₁₈H₂₇O₂ Stearic acid, dihydroxydiiodo-, 2637¹.
- C₁₈H₂₇O₂ (See also *Quercic acid*.)
- Chaulmoogric acid, dihydro-, 2476¹.
- Elaidic acid, 2638¹, 3396¹; *salts*, 1406¹.
- C₁₈H₂₇O₂ Compd., b. 210-20¹, from θ -hydroxy- θ pelargonaldehyde and CH₃(OH), 469¹.
- Lactarinic acid, 1528¹.
- Ricinoleic acid, 2326¹.
- C₁₈H₂₇O₂ Methanestannonic acid, penta-propionate, 465¹.
- C₁₈H₂₇BrO₂ Stearic acid, α -bromo-, 3396¹.
- C₁₈H₂₇IO₂ Stearic acid, hydroxyiodo-, 2637¹.
- C₁₈H₂₇NO₂ Lactarinic acid, oxime, 1128¹.
- C₁₈H₂₇O Octadecanone, 1692¹, 2807¹.
- Stearic acid, 3261¹.
- C₁₈H₂₇O₂ (See also *Stearic acid*.)
- Cetyl alcohol, acetate, 759¹.
- C₁₈H₂₇O₂ Stearic acid, hydroxy-, 467¹, 2020¹.
- C₁₈H₂₇O₂ Stearic acid, dihydroxy-, 2362¹, 2937¹.
- C₁₈H₂₇IO₂ Octadecanone, 1692¹, 2807¹.
- C₁₈H₂₇NO Acetamide, hexadecyl-, 759¹, 1127¹.
- Stearamide, 3396¹.
- C₁₈H₂₇ Octadecane, 1692¹.
- C₁₈H₂₇N₂O₂ Stearic acid, β -hydroxy-, hydrazide, *and HCl*, 2027¹.
- C₁₈H₂₇O Octadecanol, 1127¹.
- C₁₈H₂₇Br₂O₂ 3-Isoxanthone, tetrabromo-6-hydroxy-9-phenyl-, 1567¹.
- C₁₈H₂₇Br₂O₂ 3-Isoxanthone, tetrabromo-6-hydroxy-9-salicyl-, 1567¹.
- C₁₈H₂₇Br₂O₂ 3-Isoxanthone, tetrabromo-9-(2,4-dihydroxyphenyl)-, 6-hydroxy-, 1567¹.
- Resorcin - α, β - dihydroxybenzein, tetrabromo-, 2487¹.
- C₁₈H₂₇Cl₂O₂ Addn. compd. of naphthol and perchloroindone, 1258¹.
- C₁₈H₂₇Cl₂NO₂ Anthraquinone, 1,2,3,4-tetrachloro-6-(dihydroxymethyl)-5-nitro-, diacetate, 2045¹.
- C₁₈H₂₇K₂NO₂ 3-Isoxanthone, 6-hydroxy-9-(4-hydroxy-3-nitrophenyl)-, di-K salt, 1567¹.
- C₁₈H₂₇NaO₂ 1,3-Indandione, 2,2'-methylenebis-, Ba deriv., 3486¹.
- C₁₈H₂₇Br₂O₂ 3,4'-Bicoumarin, 3', (?)-dibromo-7'-methyl-, 824¹.
- C₁₈H₂₇Br₂O₂ Resorcinolgallesin, dibromo-, 2197¹.
- C₁₈H₂₇Br₂O₂ 8 Bromophenol blue, 1828¹.
- C₁₈H₂₇Cl₂O₂ 3,4'-Bicoumarin, 6,8-dichloro-7'-methyl-, 824¹.
- C₁₈H₂₇Cl₂O₂ Anthraquinone, 1,2,3,4-tetrachloro-6-(dihydroxymethyl)-, diacetate, 2046¹.
- C₁₈H₂₇K₂O₂ 3-Isoxanthone, 6-hydroxy-9-salicyl-, di-K salt, 1567¹.
- C₁₈H₂₇NaO₂ 1,3-Indandione, 2,2'-methylenebis-, di-Na deriv., 3486¹.
- C₁₈H₂₇Br₂O₂ 3,4'-Bicoumarin, 6-bromo-7'-methyl-, 824¹.
- C₁₈H₂₇BrO₂ Coumarilic acid, (?)-bromo-2-[2-keto-3-(1,2-benzopyranyl)]-5-methyl-, 824¹.
- C₁₈H₂₇Br₂NO₂ Resorcinolbenzein, α -aminodibromo-, 2197¹.
- C₁₈H₂₇Cl₂NO₂ 3-Isophenoxazone, 9-chloro-4-salicylaminobis-, 2340¹.
- C₁₈H₂₇ClO₂ 3,4'-Bicoumarin, 6-chloro-7'-methyl-, 824¹.
- C₁₈H₂₇NO₂ 3-Isoxanthone, 6-hydroxy-9-(4-hydroxy-3-nitrophenyl)-, 1567¹.
- C₁₈H₂₇BrCl₂NO₂ 1-(1,5-Dichloro-9-anthryl)pyridinium bromide, 60¹.
- C₁₈H₂₇BrCl₂NO₂ 1-(1,5-Dichloro-9,10-dihydro-10-keto-9-anthryl)pyridinium bromide, 2490¹.
- 1-(1,5-Dichloro-10-hydroxy-9-anthryl)pyridinium bromide, 2490¹.
- C₁₈H₂₇N₂O 1,3-Benzodiazole, 1,2(1',8')-naphthyleneimethyl-, 830¹.
- C₁₈H₂₇N₂O₂ Compd. from 1,2-diphenyl-3-pentadienone and thiocyanogen, m. 151¹, 2327¹.
- C₁₈H₂₇O₂ 3-Isoxanthone, 9-(*p*-hydroxyphenyl)-, 649¹.
- C₁₈H₂₇O₂ 3,4'-Bicoumarin, 7'-methyl-, 824¹.
- 1,3-Indandione, 2,2'-methylenebis-, 494¹, 3486¹.
- , 2-(3,4-methylenedioxycinnamal)-, 2048¹.
- 3-Isoxanthone, 9-(2,4-dihydroxyphenyl)-, 6-hydroxy-, 1568¹.
- , 6-hydroxy-9-salicyl-, 1567¹.
- Resorcinolgallesin, 2197¹.
- C₁₈H₂₇O₂ 3,4'-Bicoumarin, 7'-methoxy-, 824¹.
- Hydroquinol- α, ω' -dihydroxybenzein, 2487¹.
- 3-Isoxanthone, 6-hydroxy-9-(2,4-dihydroxyphenyl)-, 1567¹.
- , 4,6,6-trihydroxy-9-salicyl-, 1567¹.
- Pyrogallolbenzein, *and HCl*, 649¹.
- Resorcin- α, β -dihydroxybenzein, 2487¹.

- $C_{11}H_{10}O_3$ 3-Isoxanthone, 6-hydroxy-9-(2,3,4-trihydroxyphenyl), 1567⁹.
 Pyrogallolsalicylein, 2197¹.
 Resorcinolgallein, 2197¹.
 $C_{11}H_{10}O_3$ Pyrogallol-*o*, *m*, *p*-trihydroxybenzein, 2487¹.
 $C_{11}H_{11}AsClNO$ Phenarazine, 6-benzoyl-1-chloro-1,6-dihydro-, 478⁹.
 $C_{11}H_{11}BrN_2O_4$ Hydroquinol, 2-bromo-6-phenylazoxy-, monobenzoate, 44¹.
 $C_{11}H_{11}Cl_2N_2$ Benzophenone, 2,4,6-trichlorophenylhydrazone, 2647¹.
 $C_{11}H_{11}NO_3$ 1(2)- β -Naphthofuranone, 2-*o*-tolylimino-, 64¹.
 $C_{11}H_{11}NO_3$ Resorcinolbenzein, *o*-amino-, and *K* salt, 2197^{1,2}.
 $C_{11}H_{11}NO_4$ Dipicolinic acid, di-Ph ester, 2954¹.
 Isocinchomeronic acid, di-Ph ester, 2954¹.
 Lutidinic acid, di-Ph ester, 2954¹.
 $C_{11}H_{11}NO_5$ 8-Dibenzoguinolizone, 5,6-dihydro-2,3,10,11-bismethylenedioxy-, 2671¹.
 $C_{11}H_{11}NO_5$ Addn. compd. of 1-nitroso-2-anthraquinonecarboxylic acid(?) and Ac_2O , 2945⁷.
 Anthraquinone, 2-(dihydroxymethyl)-1-nitro-, diacetate, 2045⁷.
 $C_{11}H_{11}N_2Na$ Propene, 1-(3-indyl)-3-(3-pseudoindylidene), *N*-Na deriv., 3488⁷.
 $C_{11}H_{11}N_2O$ Isoxazole, 3,5-diindyl-, 2493¹.
 2-Naphthol, 1-(8-quinolylazo)-, 1280¹.
 $C_{11}H_{11}N_2O_4$ *N*-Methyltriphenodioxazonium nitrate, 1283⁹.
 $C_{11}H_{11}N_2O_4$ Hydroquinol, 2-nitro-6-phenylazoxy-, monobenzoate, 44¹.
 $C_{11}H_{11}N_2O_4$ 2-Stilbazole, *o'*-nitro-, picrate, 1573¹.
 $C_{11}H_{11}O$ 9-Xanthyl, 9-phenyl-, 2486⁴.
 $C_{11}H_{11}$ Fluorene, 9-phenyl-, 2300⁸.
 $C_{11}H_{11}AsNO_2$ Phenazarsinic acid, 6-benzoyl-, 478⁹.
 $C_{11}H_{11}BNO_3 + H_2O$ Disalicylicboric acid, pyridine salt, 2179¹.
 $C_{11}H_{11}Br_2N$ Benzaldehyde, α -phenylazo-, 2,4-dibromophenylhydrazone, 2332¹.
 $C_{11}H_{11}ClNO$ 2,3,10,11-Bismethylenedioxydibenzoguinolizinium chloride, 2671¹.
 $C_{11}H_{11}Cl_2NO_2$ Pyridine, 4,5-dibenzamido-2-chloro-, 77¹.
 $C_{11}H_{11}Cl_2N_2$ Benzophenone, 2,4-dichlorophenylhydrazone, 2647¹.
 $C_{11}H_{11}Cl_3O$ Addn. compd., decomps. 70-1 $^{\circ}$, of durol and perchlorodione, 1258⁹.
 $C_{11}H_{11}INO_4$ 2,3,10,11-Bismethylenedioxydibenzoguinolizinium iodide, 2671¹.
 $C_{11}H_{11}N_2O_4$ 2,8'-Benzimidazole-1-naphthoic acid, 6-methyl-, 830⁸.
 9-Fluorylamine, *N*-(*p*-nitrophenyl)-, 2658¹.
 9-Fluorylamine, 2-nitro-*N*-phenyl-, 2658¹.
 Naphthalimide, *N*-(2-aminotolyl)-, 830⁸.
 1,3-Propanedione, 2,3-diindyl-, 2493¹.
 $C_{11}H_{11}N_2O_5$ Oxindole[$\Delta^{3,4}$]rhodanine, 3' [2,4 (and 2,5)-xylyl-, 1422⁹.
 $C_{11}H_{11}N_2O_5$ Hydroquinol, 2-phenylazo-, monobenzoate, 44¹.
 $C_{11}H_{11}N_2O_5$ Hydroquinol, 2-phenylazoxy-, monobenzoate, 44¹.
 $C_{11}H_{11}N_2O_7$ 5(4)-Oxazolone, 4-(5-nitrovanillal)-2-phenyl-, acetate, 2652¹.
 $C_{11}H_{11}N_3$ 1,2,3-Benzotriazine, 3,4-dihydro-3-phenyl-4-phenylimino-, 645⁷.
 Pyrazole, 3,5-diindyl-, 2493¹.
 $C_{11}H_{11}O_2$ 2(1)- β -Naphthofuranone, 1-methyl-1-phenyl-, 1277¹.
 Phergl, *p*-phenyl-, benzoate, 1858⁷.
 Xanthene, 9-(*p*-hydroxyphenyl)-, 649⁷.
 $C_{11}H_{11}O_2$ Aurin, 647⁷.
 1-Naphthol acid, 8-toluy-, 497².
 $C_{11}H_{11}O_2$ Naphthalic acid, 4-benzyl-, 652¹.
 Umbelliferone, 4-methyl-, cinnamate, 619⁹.
 $C_{11}H_{11}O_2S$ Phenolsulfonephthalic acid, 80⁸, 674⁹, 1721¹.
 $C_{11}H_{11}O_2$ Anthraquinone, dihydroxymethoxy-, diacetate, 3270⁹.
 $C_{11}H_{11}$ Triphenylmethyl-, 2037⁷, 2486⁴, 2948⁸.
 $C_{11}H_{11}AsN_2O_3$ Benzenearsonic acid, (acridylamino)-, and derivs., P 3352².
 $C_{11}H_{11}BrN_2S$ Thiazolidine, (*p*-bromophenyl)(1-naphthylimino)-, 2481¹.
 $C_{11}H_{11}Cl$ Methane, chlorotriphenyl-, 245¹, 271⁴, 2479¹.
 $C_{11}H_{11}CrN_2NaO_3$, 67².
 $C_{11}H_{11}N$ Stilbazole, α -phenyl-, and -HCl, 2498^{1,2}.
 $C_{11}H_{11}NO$ Acenaphthene, benzamido-, 651¹, 3268⁹.
 $C_{11}H_{11}NO_2$ Benzanilide, 3-hydroxy-5-phenyl-, 1858⁷.
 -*o*-phenoxy-, 1699⁸.
 Cinchophen, allyl ester, -HI, P 78⁹.
 $C_{11}H_{11}NO_2S$ Diphenylamine, benzylthio-, sulfone, 2646¹.
 $C_{11}H_{11}NO_2$ Dehydrocusparine, and -HCl, 293⁸.
 $\Delta^{1,4}$ -3-Heptatrienone, 7-(nitrophenyl)-1-phenyl-, 1266².
 $C_{11}H_{11}NO_2$ Dibenzoguinolizine, 5,6-dihydro-2,3,10,11-bismethylenedioxy-, 2671¹.
 Quinaldine, α -benzal-, oxalate, 1267¹.
 $C_{11}H_{11}NO_2$ Isoquinoline, 6,7-dimethoxy-1-(3,4-methylenedioxybenzoyl)-, 520⁹.
 -6,7-methylenedioxy-1-veratroyl-, 520⁹.
 $C_{11}H_{11}NS$ Diphenylamine, benzylthio-, 2645⁹.
 $C_{11}H_{11}NO$ 1(2)-Pyrimidoguinolone, 3,5-dimethyl-2-phenyl-, 2955⁷.
 $C_{11}H_{11}N_2O_2$ Benzanidine, *m*-nitro-, *N*, *N'*-diphenyl-, and -HCl, 645⁷.
 Benzophenone, *p*-nitrophenylhydrazone, 2827⁷.
 Pyridine, 3,4-dibenzamido-, 70⁸.
 $C_{11}H_{11}NO_7$ 2-Stilbazole, *o'*-amino-, picrate, 1573¹.
 $C_{11}H_{11}$ Acenaphthene, 3-benzyl-, 652¹.
 Methane, triphenyl-, 271⁴, 1410⁷, 2300⁸.
 Naphthalene, 1- α -ethylidenebenzyl-, 2820⁸.
 $C_{11}H_{11}Br_2O_3$ Chromone, 7-methoxy-2-methyl-3-piperonyl-, dibromide, 2653¹.
 $C_{11}H_{11}Cl_2O$ Δ^2 -Butenedione, 1,4-bis(4-chloromethyl)-2-methoxy-, 1268⁹.
 $C_{11}H_{11}CrN_2O_4 + 2.5 H_2O$, 67².
 $C_{11}H_{11}N_2O$ Acridoline, 1,2,3,4-tetrahydro-, 293⁸.
 2,9-Fluorenediamine, *N*²-phenyl-, 2658⁴.
 Methane, (2-methyl-4-indyl)(2-methyl-3-pseudoindylidene), perchlorate, 3488⁷.
 Pseudindole, 2-methyl-3-(2-methyl-3-indylmethylene)-, and derivs., 1267¹.
 $C_{11}H_{11}NO_7$ 7(12⁹) Acridolinone, 1,2,3,4-tetrahydro-, and salts, 293⁸.
 1-Carbazolecarboxylic acid, 9-(*o*-aminophenyl)-5,6,7,8-tetrahydro-, inner anhydride, 521¹.
 Compd., *m*. 262⁹, from 9-(α -aminophenyl)-5,6,7,8-tetrahydrocarbazole-1-carboxylic acid, 521¹.
 $C_{11}H_{11}N_2O_2$ Diphenylamine, *N*-benzyl-*p*-nitro-, 2645⁷.
 -*N*,*p*-nitrobenzyl-, 2645⁷.
 $C_{11}H_{11}N_2O_2$ Isoquinolidonitrile, 2-benzoyl-1,2-dihydro-6,7-dimethoxy-, 2668¹.

- 3-Pyrrolidinecarboxylic acid, 5-cyano-2-keto-4-methyl-1,5-diphenyl-, 503⁷.
- C₁₉H₁₉N₂O₄ 2,5-Piperazine-1-one, 1,4-dibenzoyl-3-methyl-, 995².
- C₁₉H₁₉N₂O₄ Isoquinoline, 6,7-dimethoxy-1-(3,4-methoxyphenyl)-, oxime, 520².
- , 6,7-methylenedioxy-1-veratroyl-, oxime, 520².
- C₁₉H₁₉N₂O₄ Thiazolidine, 2-(1-naphthylimino)-3-phenyl-, 2481⁴.
- C₁₉H₁₉N₂O₄ Acridine, tetrahydro-, picrate, 521².
- C₁₉H₁₉N₂O₄ Creatinine, 3-acetyl-5-benzal-, picrate, 1853².
- C₁₉H₁₉O₄ Carbinol, triphenyl-, -HCl(?), 2479².
- C₁₉H₁₉O₄ 2,2'-(1,1') Spirobi naphthalene-1,1'-dione, 3,4,3',4'-tetrahydro-, 61².
- C₁₉H₁₉O₄ Benzaurin, 2710².
- Coumarin, 4 - (*p* - methoxystyryl)-7-methyl-, 2485⁷.
- Cyclopentanone, 2,5-bis(*p*-hydroxybenzal)-, salts, 1415¹.
- Δ²-Cyclopentanone, 5-methyl-3-(3,4-methoxyphenyl)-4-phenyl-, 2934².
- †-Hemitruxinonic acid, Me ester, 2826².
- Succinic anhydride, α-benzal-β-phenethyl-, 3265⁷.
- C₁₉H₁₉O₄ Coumarin, 3,4-dihydro-4-(*o*-hydroxyvinnylmethyl)-, 484².
- , 4 - (4 - hydroxy - 3 - methoxystyryl)-7-methyl-, 2485⁷.
- Spiro compound from bis(β-phenoxyethyl)-malonyl chloride, m. 179-81°, 62¹.
- Succinic anhydride, β-benzal-α-hydroxy-α-phenethyl-(?), 3265⁷.
- , α-benzyl - α - hydroxy-β-(β-phenylethylidene)-(?), 3265⁷.
- C₁₉H₁₉O₄ Chalcone, 4,4'-dihydroxy-, diacetate, 1414².
- Chromone, 7-methoxy-2-methyl-3-piperonyl-, 2653¹.
- C₁₉H₁₉O₄ Anthraquinone, 5-hydroxy-1,2-dimethoxymethyl-, acetate, 652², 2491².
- C₁₉H₁₉O₄ Arabonic acid, γ-lactone, dibenzoate, 817².
- Benzil, 2,4-dihydroxymethoxy-, diacetate, 2946².
- Emodic acid, isobutyl ester, 1861².
- C₁₉H₁₉BrN₂O₄ Urea, (*p*-bromophenyl)(β-hydroxyethyl)-1-naphthylthio-, 1481².
- C₁₉H₁₉BrN₂S₂ Thiazolepurple, 2054².
- C₁₉H₁₉BrO₄ 2(1)-Benzofuranone β-bromo-5-methoxy-1-(3,4,5-trimethoxybenzyl)-, 2207⁴.
- C₁₉H₁₉BrO₄ 2(1)-Benzofuranone, β-bromo-5-methoxy - 1 - (3,4,5 - trimethoxybenzyl)-, 2207⁴.
- C₁₉H₁₉Br₂O₄ 2(1)-Benzofuranone, β,1,2-dibromo-1-(α-bromo - 3,4,5 - trimethoxybenzyl)-5-methoxy-, 2207⁴.
- C₁₉H₁₉ClN₂O₄ Thiocyanine perchlorate, 1 1'-dimethyl - strepto - monovinylene - 2,2', 2054².
- C₁₉H₁₉ClO₄ 7 - Hydroxy - 2 - (*o* - 4) - (*p* - methoxystyryl) - 4(or 2) - methylbenzopyrylium chloride, 1707².
- C₁₉H₁₉ClO₄ 7 - Hydroxy - 4 - (4 - hydroxy - 3 - methoxystyryl) - 2 - methylbenzopyrylium chloride, 1707².
- C₁₉H₁₉ClN₂O₄ Δ^{1,2} - Pentadienylamine, *N*-phenyl - *o*-phenylimino-, trichloroacetate, 1267².
- C₁₉H₁₉IN₂O₄ Oxazole yellow, 2054².
- C₁₉H₁₉IN₂O₄ β - Methoxy - 1 - methyl - α - (*m*-nitrobenzyl)quinazolinium iodide, 2668².
- C₁₉H₁₉IN₂S₂ Thiocyanine iodide, 1,1'-dimethyl-strepto-mono-vinylene-2,2', 2054².
- C₁₉H₁₉N₂ Diphenylamine, *N*-benzyl-, 2645².
- Naphthylamine, *N*-danzyl-, 1520².
- C₁₉H₁₉NO₄ Cinchophenyl Pr ester, -HI, P 78².
- Quinoline, methoxy(methoxystyryl)-, and salts, 1279², 2.
- C₁₉H₁₉NO₄ Cusparine, 292².
- Guaiacol, 4-[4(and 7)-methoxy - 2 - quinolyl-β-vinyl]-, and salts, 1279², 2.
- Succinimide, α - benzyl - α, β - epoxy - β - phenethyl-, 3265⁷.
- C₁₉H₁₉NO₄ 1(or 2)-Propanesulfonic acid, 3-(2-naphthylimino)-1-phenyl-, and *NH₄* salt, 2328².
- C₁₉H₁₉NO₄ Dibenzoquinolizine, 5,6,13,13'-tetrahydro - 2,3,10,11 - bismethylenedioxy-, 2670².
- C₁₉H₁₉NO₄ Isoquinoline, 3,4-dihydro-6,7-dimethoxy - 1 - (3,4 - methylenedioxybenzoyl)-, and -HI, 520².
- , 3,4 - dihydro - 6,7 - methylenedioxy - 1 - veratroyl-, and -H₂, 520².
- Nitrone, *N*-(*p*-carboxyphenyl)-α-(3,4-methylenedioxy-styryl)-, Et ester, 47².
- 5(4) - Oxazolone, 2 - phenyl - 4 - (3,4,5 - trimethoxybenzyl)-, 2672².
- Quinoline, 2 - (3,4 - dimethoxyphenyl) - 3 - methoxy-6,7-methylenedioxy-, 1141⁴.
- C₁₉H₁₉N₂O₄PS Thiophosphate hydrazide, benzal deriv., di-Ph ester, 2326².
- C₁₉H₁₉N₂ Benzamidine, amino-*N*, *N'*-diphenyl-, and salts, 645², 2.
- Guanidine, triphenyl-, 2425⁴.
- C₁₉H₁₉N₂O₄ Acridine, aminotetrahydro-, picrate, 521².
- C₁₉H₁₉O₄PS Thiophosphoric acid, di-Ph *p*-tolyl ester, 2325².
- C₁₉H₁₉AsBrO₄ Addn. compd., m. 145-50°, of bromoacetic acid and methyl-1-naphthylphenylarsine, 2038².
- C₁₉H₁₉AsNO₄ Cinchoninic acid, 2-(*p*-arsonophenyl)-6-methyl-, Et est., 1256¹.
- C₁₉H₁₉Cl₂O₄ Malonyl chloride, diphenethyl-, 61².
- C₁₉H₁₉Cl₂O₄Te 1,2-Telluropyran-3,5(4,6)-dione, 4,4-dibenzyl-, 1,1-dichloride, 2027².
- C₁₉H₁₉Cl₂O₄ Malonic acid, bis(β-chloroethyl)-, di-Ph ester, 62¹.
- Malonyl chloride, bis(β-phenoxyethyl)-, 61².
- C₁₉H₁₉N₂ Acridoline, 1,2,3,4,7,12-hexahydro-, 293².
- 2 - Naphthylamine, *N* - *p* - dimethylamino-benzal-, 1416².
- Quinaldine, α-*p*-dimethylaminobenzal-, salts, 1267².
- C₁₉H₁₉N₂O₄ Urea, α-(β-hydroxyethyl)-β-1-naphthyl-α-phenylthio-, 2481².
- C₁₉H₁₉N₂O₄ Acrylophenone, β,β'-methylhydrazonobis-, 2049².
- 1 - Carbazolecarboxylic acid, 9 - (*o* - amino-phenyl) - 5,6,7,8 - tetrahydro-, 521⁴.
- C₁₉H₁₉N₂O₄ Pyrazinoacridine - 3(7)-acetic acid, 1,2-dihydro-1-keto-, Et ester, 296¹.
- C₁₉H₁₉N₂O₄S 1,6 - Pyridopyridine - 3 - carboxylic acid, 1,5,6,7 - tetrahydro - 5 - 7 - diketo - 1,2-dimethyl-6-phenyl-7-thio-, Et ester, 2497².
- C₁₉H₁₉N₂O₄ 1,6 - Pyridopyridine - 3 - carboxylic acid, 1,5,6,7 - tetrahydro - 5,7 - diketo - 1,2-dimethyl-6-phenyl-, Et ester, 2497².
- C₁₉H₁₉N₂O₄S 1(2),1' - Spiro[benzofuran - benzothiazoline] - 2 - one, 2' - acetyl - 5' - dimethylamino - 5 - methoxy-, 2047².

- C₁₉H₁₉N₃O₂ Benzil, *p*-methoxy-, dioxime, di-Ac deriv., 2819⁴.
 Isoquinoline, 3,4-dihydro-6,7-dimethoxy-1-(3,4-methylenedioxybenzoyl)-, oxime, 520⁴.
 —, 3,4-dihydro-6,7-methylenedioxy-1-veratroyl-, oxime, 520⁴.
 C₁₉H₁₉N₃O₂ 5,5'-Spiro[bi(*m*-dioxan)]-2-ol, 2'-(*o*-nitrophenyl)-2-(*o*-nitrosophenyl)-, 2932⁴.
 5,5' - Spiro[bi(*m*-dioxane), 2,2' - bis(*o*-nitrophenyl)-, 2932².
 C₁₉H₁₉N₃O₂ Quinoline, dimethoxy-2,4-dimethyl-, picrate, 2344^{2,4}.
 C₁₉H₁₉N₃O₂ Malonic acid, bis(formylmethyl)-, bis(*p*-nitrophenylhydrazono), 1129⁴.
 C₁₉H₁₉O₂ Δ² - Cyclopentenone, 3 - *p* - anisyl - 5 - methyl-4-phenyl-, 2934⁴.
 C₁₉H₁₉O₂Te 1,2 - Telluropyran - 3,5(4,6) - dione, 4,4-dibenzyl-, 2027⁴.
 C₁₉H₁₉O₂ Benzoic acid, *o* - [β - (1,2,3,4 - tetrahydro - 1 - keto - 2 - naphthyl)ethyl]-, 61⁵.
 Δ² - 1,4 - Butenedione, 2 - methoxy - 1,4 - ditolyl-, 1268⁴.
 3 - Pentadienone, 1,5-dianisyl-, 484⁴, 1258².
 Succinic anhydride, *α*-benzyl-β-phenethyl-, and isomer, 3265⁴.
 C₁₉H₁₉O₂ 2-Benzofuranacetic acid, 1,2-dihydro-1-keto-4-methyl-2-phenyl-, Et ester, 1277¹.
 Succinic acid, *α*-benzyl-β-phenethyl-, 3265².
 C₁₉H₁₉O₂ Chalcone, 4'-hydroxy-2,3-dimethoxy-, acetal, 983².
 Chromone, 7-hydroxy-2-methyl-3-veratryl-, 2653⁴.
 Δ^{1,4} - 3 - Pentadienone, 1,5 - bis(4 - hydroxy-*m*-anisyl)-, 2143⁷.
 Rotenone, 1708², 3183⁴.
 2(3),9' - Spiro[furan - xanthen] - 5(4) - one, 4 - ethyl - 3',6' - dihydroxy - 4 - methyl-, 986².
 2,9' - Spiro[1,2 - pyran - xanthen] - 6(5) - one, 3,4-dihydro - 3',6' - dihydroxy - 4,4 - dimethyl-, 986².
 Succinic acid, *α* - benzyl - *α*, β - epoxy - β - phenethyl-, 3265².
 C₁₉H₁₉O₂ Benzofuran, 3,5 - dimethoxy - 1 - veratroyl-, 2041⁴.
 2(1) - Benzofuranone, 3,5 - dimethoxy - 1 - veratroyl-, 483².
 —, 5 - methoxy - 1 - (3,4,5 - trimethoxybenzyl)-, 2207⁴.
 C₁₉H₁₉O₂ Myricetin tetramethyl ether, 114³.
 C₁₉H₁₉BrO₂ 2 - *p* - Anisyl - 8 - ethoxy - 3 - methoxybenzopyrylium bromide, 520¹.
 C₁₉H₁₉BrO₂ Benzofuran, (?) - bromo - 3,5 - dimethoxy-1-veratryl-, 2041⁴.
 C₁₉H₁₉ClO₂ 4 - *p* - Anisyl - 3,5 - dimethoxy - 2 - methylbenzopyrylium chloride, FeCl₃ compd., 517⁴.
 2 - *p* - Anisyl - 8 - ethoxy - 3 - methoxybenzopyrylium chloride, and FeCl₃ compd., 520¹.
 C₁₉H₁₉ClO₂ 2 - *p* - Anisyl - 3,5,7 - trimethoxybenzopyrylium chloride, 654⁴.
 2 - (2,4 - Dimethoxyphenyl) - 5,7 - dimethoxybenzopyrylium chloride, and FeCl₃ compd., 2341⁴.
 C₁₉H₁₉ClO₂ + 2H₂O 5,7-Dihydroxy - 3 - methoxy-2 - (3,4,5 - trimethoxyphenyl)benzopyrylium chloride, 2342⁴.
 C₁₉H₁₉NO 3-Pentadienone, 2 - (*p* - dimethylaminophenyl) - 5 - phenyl-, salts, 1263².
p - Phenetidine, *N* - (*α* - phenyl - Δ^{1,4} - pentadienylidene)-, 2941⁴.
 C₁₉H₁₉NO₂ 1,3(2,4) - Isoquinolinedione, 4,4 - dimethyl - 2 - *p*-phenethyl-, 2958².
 C₁₉H₁₉NO₂ Cinnamic acid, *p*-anisalamino-, Et ester, 1646².
 2 - Quinolinedethanol, *α*-*p* - anisyl - 7 - methoxy-, and salts, 1279⁴.
 Trilobine, 1708².
 Truxinamic acid, Me ester, 2826¹.
 C₁₉H₁₉NO₂ Succinamic acid, *α* - (or β)-benzyl-*α*, β-epoxy-β-(or *α*)-phenethyl-, 3265².
 C₁₉H₁₉NO₂ Cinnamic acid, *α*-benzamido-3,4,5-trimethoxy-, 2652⁴.
p - Toluic acid, *α* - 2,4 - dimethoxybenzal-3-nitro-, Et ester, 1419⁴.
 —, 3-nitro-*α*-veratral-, Et ester, 1420².
 C₁₉H₁₉NO₂ 1,2 - Benzopyran - 3,4 - dione, 7-methoxy - 2 - (3,4,5 - trimethoxyphenyl)-3-oxime, 2207⁴.
 C₁₉H₁₉BrNO₂ Isoquinoline, 1 - (6 - bromoveratryl) - 1,2,3,4 - tetrahydro - 6,7 - methylenedioxy-, and HCl, 2169⁴.
 C₁₉H₁₉BrNO₂ Homoveratramide, 6-bromo-*N*-homopiperonyl-, 2669⁴.
 C₁₉H₁₉N₂O₂ Acridan, 1-(β-hydroxyethylamino)-, di-Ac deriv., 295⁴.
 C₁₉H₁₉N₂O₂ Malonic acid, acetylphenyl-, di-Me ester, phenylhydrazono, 1566².
p-Toluic acid, *α*-(*p*-dimethylaminobenzal)-3-nitro-, Et ester, 1420⁴.
 C₁₉H₁₉N₂O₂ *α*-Toluenesulfonic acid, *α*-(formylmethyl)-, 2-naphthylamine salt, *oxime*, 2228².
 C₁₉H₁₉N₂O₂ Anthranilic acid, *N*-(*o*-acetamidophenyl)-*N*-(carboethoxymethyl)-, 521².
 C₁₉H₁₉N₂O₂ Isoquinoline, 1,2,3,4-tetrahydro-6,7-methylenedioxy - 1 - (6 - nitroveratryl)-, 2669⁴.
 Succinic acid, *α*-(hydroxymethoxy) - *α* - [(phenylcarbamyl)methyl]-, *γ* - lactone, PhNH₂ salt, 3255².
 C₁₉H₁₉N₂O₂ Acridine, octahydro-, picrate, 522¹.
 C₁₉H₁₉O₂ Δ¹ - 3 - Hexenone, 1 - phenyl - 5 - *p* - tolyl-, 277².
γ - Pentenophenone, *α* - benzyl - *α* - methyl-, 1134².
 C₁₉H₁₉O₂ 2,4-Pentanedione, 3,3-dibenzyl-4 2027⁴.
 C₁₉H₁₉O₂ Cinnamic acid, *p*-anisalamino-, ethyl ester, 1072⁴.
 C₁₉H₁₉O₂ Chalcone, 4,4' - diethoxy - 2' - hydroxy-, 3064⁴.
 Malonic acid, diphenethyl-, 61⁴.
 3-Pentanol, 1-phenyl-, acid phthalate, 2330⁴.
 3 - Pentanone, 1² (4 - hydroxy - *m* - Anisyl)-, benzoate, 2943².
 Phthalic acid, benzyl Bu ester, P³491⁵.
 Succinic acid, *α*-benzyl-β-phenethyl-, and isomer, 3265^{4,5}.
 C₁₉H₁₉O₂ Anhydroepiccatechol, tetramethyl-, 1260¹, 2041⁴.
 Benzofuran, 3,5 - dimethoxy - 1 - veratryl-, 2041⁴.
 Rotenone, dihydro-, 1708⁴.
 C₁₉H₁₉O₂ Benzofuran, 1,2-dihydro - 3,5 - dimethoxy-4(and 6)-veratroyl-, 484¹.
 2(1) - Benzofuranone, 3,5-dimethoxy - 1 - veratryl-, 483², 1260⁴.
 Chalcone, 2-hydroxytetramethoxy-, 2041⁴, 2207², 2341⁴.
 Flavanone, 7,3',4',5'-tetramethoxy-, 2207².
 Malonic acid, bis(β-phenoxymethyl)-, 61⁴.
 Propiophenone, 2,4,5, trimethoxy - β-(3,4-methylenedioxyphenyl)-, 823⁴.
 C₁₉H₁₉NO₂ *p*-Cresol, 2-*α*-methyl-Δ²-butenyl-, carbamate, 2038².

- C₁₀H₁₉NO₃ (See also *Thebaine*.)
Glycine, *N*-(α , β -di β -benzylpropionyl)-, Et ester, 2052³.
- C₁₀H₁₉NO₃ Pseudocumidine, naphthalenesulfonate, 650³.
- C₁₀H₁₉NO₃ Adamine, 4,5-dimethoxy-*N*-piperonylidene-2-propyl-, and -HCl, 2474³.
Cartamic acid, benzylhydroxy-, Bu ester, benzoate, 909³.
Malonic acid, α -*m*(and *p*)-toluinobenzyl-, di-Me ester, 1410³.
- C₁₀H₁₉NO₃ Nicotinic acid, 5-acetyl-4-*p*-anisyl-1,6-dihydro-6-keto-1,2-dimethyl-, Et ester, 2497³.
- C₁₀H₁₉N₂O₄ Isozingerone, benzoate semicarbazone, 2944³.
- C₁₀H₁₉N₂O₄ 1-Isoquinolinemethylamine, 1,2,3,4-tetrahydro-8-methoxy-2-methyl-6,7-methylenedioxy-, picrate, 2669³.
- C₁₀H₁₉NO₂ Aporphinemethine, methiodide, 2500³.
- C₁₀H₁₉N₂O See *Cinchonidine*; *Cinchonine*.
- C₁₀H₁₉N₂O Apocuinine, 2055³.
1,2-Propanediamine, *N*, *N'*-diacetyl-*N*, *N'*-diphenyl-, 492³.
- C₁₀H₁₉N₂O₄ 4-Isopyrrolomethylmalonic acid, 3,5-dimethyl-2-(*p*-dimethylaminobenzal)-, derivs., 2823³.
Malonamide, α , α -bis(β -phenoxyethyl)-, 611³.
Tyrosine, *N*-(*N*-phenylglycyl)-, Et ester, 3083³.
- C₁₀H₁₉N₂O₃ Sulfonic acid from quinine, and salts, 1425³.
- C₁₀H₁₉N₂O₇ 4,5'-Bipyrrole-3-carboxylic acid, 5-formyl-4'-hydroxy-2,2'-dimethyl-, di-Et ester, acetate, 75³.
- C₁₀H₁₉N₂S Thiazolidine, 3-(2,5-xylyl)-2-(2,5-xylylimino)-, 2481³.
- C₁₀H₁₉N₂O Piperazine, 2-methyl-1,4-bis(phenyl carbamyl)-, 2033³.
- C₁₀H₁₉N₂O₃ Quinoline, 1,2,3,4-tetrahydro-6,7-dimethoxy-4,4-dimethyl-, picrate, 2344³.
- C₁₀H₁₉O Bornylene, 3-cinnamyl-, 1263³.
- C₁₀H₁₉O₂ 3,4-Hexanediol, 3-phenyl-, monobenzoate, 3254³.
- C₁₀H₁₉O₂ Benzofuran, 1,2-dihydro-7,5-dimethoxy-1-veratryl-, 483³.
Desoxycatechol, tetramethyl-, 1260³.
3-Pentanone, 1,5-bis(4-hydroxy-*m*-anisyl)-, 2943³.
- C₁₀H₁₉O₂ Benzofuran, 1,2-dihydro-4-(and 6)-(4-hydroxyveratryl)-3,5-dimethoxy-, 484³.
4-Flavanol, 5,7,3',4'-tetramethoxy-, 483³.
Propiophenone, 3,4-dimethoxy- β -(4,6-dimethoxyallyl)-, 2041³.
- C₁₀H₁₉O₂ 2,3,4-Furantricarboxylic acid, 2,3-dihydro-5-phenyl-, tri-Et ester, 246³.
- C₁₀H₁₉BrN₂O₄ Codeine, bromdihydrohydroxy-, semicarbazone, 268³.
- C₁₀H₁₉N Piperidine, 1- α -phenylphenethyl-, and -HCl, 519³.
- C₁₀H₁₉NO Benzamide, *N*2,5-dipropylphenyl-, 1406³.
- C₁₀H₁₉NO₂ Benzamide, *N*-(α -ethyl- α -hydroxypropyl)benzyl-, 635³, 3254³.
- C₁₀H₁₉N₂O₂ Aniline, *N*-anisyl-4,5-dimethoxy-2-propyl-, and -HCl, 2474³.
- Thebaine, dihydro-*N*-methyl-, -H₂, 2820³.
- C₁₀H₁₉NO Ecgonine, allylbenzoyl-, 1603³.
- C₁₀H₁₉N₂O₄ Methane, (4-carbethoxy-3,5-dimethyl- β -isopyrrolidene)(4-carbethoxy-3,5-dimethyl-2-pyrryl)- β -*N*-Na deriv., 3458³.
- C₁₀H₁₉N₂O₂ Nicotinic acid, 5-acetyl-1,6-dihydro-6-keto-1,2,4-trimethyl-, Et ester, phenylhydrazine, 2407³.
- C₁₀H₁₉N₂O₂ Galactosamine, benzoyl-, phenylhydrazine, 1560³.
- C₁₀H₁₉ClNO₃ + 2H₂O See *Dionine*.
- C₁₀H₁₉N₂ Aniline, *p*,*p'*-propenyldienebis[*N*, *N'*-dimethyl-, 2674³.
- C₁₀H₁₉N₂O Chloroaurate, m. 198-9°, of chelidonium alkaloid, 990³.
Curarine, 3325³.
Hydrocinchonine, 1425³.
Valerophenone, *p*-methoxy-, phenylhydrazine, 2671³.
- C₁₀H₁₉N₂O₃ Carbanilide, α -(β -hydroxyethyl)-2,5,2',5'-tetramethylthio-, 2481³.
- C₁₀H₁₉N₂O₃ Dye, sulfur, blue, pentamethylleuco-, 1574³.
- C₁₀H₁₉N₂O₂ Hydrocupreidine, and di-HCl, 1425³, 1426³.
Hydrocupreine, -HNO₃, 1426³.
- C₁₀H₁₉N₂O₂ Des-*N*-methylidihydrocodeinone, oxime, 2827³.
- C₁₀H₁₉N₂O₄ 3-Isopyrrolecarboxylic acid 2-[(3-carboxy-4,5-dimethyl-2-pyrryl)methylene]-4,5-dimethyl-, di-Et ester, and -HCl, 3270³, 3271³.
Methane, (4-carbethoxy-3,5-dimethyl-2-isopyrrolidene)(4-carbethoxy-3,5'-dimethyl-2-pyrryl)-, -HCl, 3488³.
- C₁₀H₁₉N₂O₂ Hydrocinchoninesulfonic acid, and -H₂SO₄, 1426³.
- C₁₀H₁₉N₂O₃ Hydrocupreinesulfonic acid, -H₂SO₄, 1425³.
Hydrocupreinesulfonic acid, and salts, 1425³.
- C₁₀H₁₉N₂O₃ Ethylsulfuric acid, 9-hydroxy 6'-hydroxy-3-rubyl-, and -HCl, 1426³.
- C₁₀H₁₉N₂O₃ Aspartic acid, *N*-(*N*,*O* dicarbo methoxytyrosyl)-, di Me ester, 1248³.
- C₁₀H₁₉N₂O₃ *d*-Glucose, methyl-, osazone, 250³.
- C₁₀H₁₉N₂S Formamidine, *C*,*C'* propylenedithio bis[*N*-methyl-*N'*-phenyl-, and -HBr, 2481³.
- C₁₀H₁₉O Camphane, 3-cinhamyl-, 1264³.
- C₁₀H₁₉O 3-Pentanol, 1,5-di-*p*-anisyl-, 58³.
- C₁₀H₁₉O₂ Malonic acid (5,6,7,8-tetrahydro-2-naphthoymethyl), di-Et ester, 1272³.
- C₁₀H₁₉O₂ Fructose, diacetone, behenate, 250³.
Tricarballic acid, α -benzoyl-, tri-Et ester, 246³.
- C₁₀H₁₉NO₂ Des-*N*-methylidihydrocodeinone, dihydro-, 2827³.
- C₁₀H₁₉NO₂ Galactosamine, diacetone, Bz deriv., 1560³.
Mannose, diacetone-, primary amine, Bz deriv., 1631³.
- C₁₀H₁₉N₂O₃ Dinicotinic acid, 4-furyl-2,6-dimethyl-, di-Et ester, methosulfate, 2490³.
- C₁₀H₁₉ Pimaric acid, dihydro-, 648³.
- C₁₀H₁₉NO₂ Codeine, dihydrodesoxy-, methiodide, 297³.
- C₁₀H₁₉NO₂ Des-*N*-methylidihydrocodeinone, dihydro-, oxime, 2827³.
- C₁₀H₁₉NO₂ Fyrrrolecarboxylic acid, methylene bis[dimethyl-, di-Et ester, 2336³, 3270³, 3271³.
- C₁₀H₁₉N₂O₂ Morphimethine, nitrotetrahydro-methyl-, -HNO₃, 2827³.
- C₁₀H₁₉O₂ 1,4-Glucose, (1,2)(5,6)-diacetone-3-benzyl-, 2036³.
- C₁₀H₁₉O₂ Fructose, diacetone-, *p*-toluenesulfonate, 250³.
- C₁₀H₁₉O₂ 2830³.

- Te-epthalophenone, 2301⁴.
 C₂₀H₁₄O₇ 7-Acenaphthene, 8-vanillal-, 821⁴.
 Phthalone, 4-(hydroxyphenyl)phenyl-, 2710⁴.
 C₂₀H₁₄O₄ (See also Phenolphthalein.)
 1,3-Indandione, 2,2'-ethylidenebis-, 3486⁴.
 Isophthalaldehyde, 271¹.
 C₂₀H₁₄O₃S 1,2-Naphthalenediol, 4-(2-naphthyl-sulfonyl)-, 3088⁴.
 C₂₀H₁₄O₃S Thioindigo white, diacetate, 504⁴.
 C₂₀H₁₄O₃ Naphthalic acid, 4-o-carboxybenzyl-, 652⁴.
 C₂₀H₁₄O₃S Thioindigo white, S-dioxide, diacetate, 504⁷.
 C₂₀H₁₄O₇ Atromentin, and salts, 639^{1,4}.
 C₂₀H₁₄O₃ Anthragallol, triacetate, 3270⁴.
 C₂₀H₁₄O₃ 2-Anthraquinonecarboxylic acid, 4,5-dihydroxy-7-methoxy-, diacetate, 1860⁴.
 C₂₀H₁₄ClN Quinoxaline, 3-chloro-1,2-dihydro-2,2-diphenyl-, 1425².
 C₂₀H₁₄N Acetonitril-, triphenyl-, 2822⁴.
 Dinaphthylamine, 2200^{1,3}.
 1-Naphthylamine, N-2-naphthyl-, 2200².
 C₂₀H₁₄NO₂ Phenolisatinin, 2197⁷.
 Phthalimidine, 3,3-bis(p-hydroxyphenyl)-, 272⁴.
 —, 3-(p-hydroxyphenyl)-3-salicyl-, 272².
 C₂₀H₁₄NO₂ Benzanilide, m-hydroxy-, m-hydroxybenzoate, 1417².
 Carbanilic acid, N-hydroxy-, Ph ester, benzoate, 3259¹.
 Isophenolphthalein, oxime, 272².
 Oxyisoprotoberberine, 2,3-methylenedioxy-, acetate, 2669¹.
 o-Toluic acid, α-(p-hydroxyphenyl)-α-(p-keto-phenylidene)-, oxime, 272².
 C₂₀H₁₄N₂O Benzophenone, p-nitro-, phenyl-carbamyl-, 490².
 C₂₀H₁₄N₂O₃ Benzothiazole, 1-(p-aminophenyl)-5-methyl-, picrate, 1411².
 C₂₀H₁₄AsN₂O₇ Arsenic acid, N-(nitrobenzamido-benzoyl)-, and Na salt, 979^{1,3}.
 C₂₀H₁₄BNO₃ Disalicylic boric acid, aniline salt, 2179¹.
 C₂₀H₁₄Br₂O Cyclohexanone, 2,6-bis(p-bromobenzyl)-, 2941².
 C₂₀H₁₄ClNO₃ Compd., m. 188°, from 5'-chloro-6'-hydroxy-1-naphtho- m - toluide and AcCl, 1562².
 C₂₀H₁₄ClNO₃ m - Benzenesulfonotoluide, 5'-chloro-6'-hydroxy-, benzoate, 1562².
 m-Benzotoluide, 5'-chloro-6'-hydroxy-, benzenesulfonate, 1562².
 C₂₀H₁₄Cl₂N₂O₄ 4,4'-Bi(5-pyrazolone), 1,1'-bis(p-chlorophenyl)-3,3'-dimethyl-, 508¹.
 C₂₀H₁₄N₂ Binaphthylamine, 8268⁴.
 Naphthylenediamine, N-naphthyl-, 2200⁴.
 C₂₀H₁₄N₂O Phenol, o-(α,β-bisphenyliminoethyl)-, 826².
 C₂₀H₁₄N₂O₂ 1,4-Butanedione, 1,4-diindyl-, 2493².
 Indole, 1,1'-succinylbis-, 279⁴.
 Naphthalimido, N - (o - ethylaminophenyl)-, 430⁷.
 3-Picoline, 2-amino-, di-β₂ deriv., 518².
 C₂₀H₁₄N₂O₂S Acridine, 2-p-tolylsulfonamido-, and HCl, 295².
 C₂₀H₁₄N₂O₂S Oxindole(Δ^{2,3})rhodanine, 3'-pseudocumyl-, 1422².
 C₂₀H₁₄N₂O₂ Acetanilide, o-nitro-α,α-diphenyl-, 1255².
 Phthalamic acid, N - [β - (p - aminophenyl)-phenyl]-, 2196¹.
 Phthalimidine, 2-amino-6,8-bis(p-hydroxyphenyl)-, 272².
 —, 2-amino-3-(p-hydroxyphenyl)-3-salicyl-, 272².
 C₂₀H₁₄N₂O₄ Anthranilic acid, N, N'-o-phenylenebis-, 294².
 Leucoisindigo, di-β₂ deriv., 2204².
 C₂₀H₁₄N₂O₄ Cyclohexanone, 2,6-bis(nitrobenzyl)-, 1266².
 C₂₀H₁₄N₂O₂ 1,3-Benzotriazole, 2-(p-anilino-phenyl)-, acetyl deriv., 514².
 Pseudoisatin, 6-amino-1-phenyl-, phenylhydrazine-, 646⁷.
 C₂₀H₁₄N₂O₃ Eriochrome red B, 219².
 C₂₀H₁₄N₂O₄ Indazole, 3-benzoyl-, 2,4-dinitrophenylhydrazine-, 508⁷.
 1,2,3-Triazole-4-carboxylic acid, 1,1'-p-biphenylenebis[5-methyl-, 476².
 C₂₀H₁₄N₂O₁₀ Urea, α-(α-hydroxybenzyl)-, picrate, 1134⁷.
 C₂₀H₁₄O Acetophenone, α,α-diphenyl-, 636².
 Benzophenone, o-benzyl-, 2950².
 —, p-methyl-p'-phenyl-, 2045².
 C₂₀H₁₄O₃ 3-Acenaphthene-o-toluic acid, 652².
 2(1)-8-Naphthofuranone, 1-ethyl-1-phenyl-, 1277².
 Xanthidrol, 9-benzyl-, perchlorate, 988⁷.
 C₂₀H₁₄O₃ 1-Naphthoic acid, 8-benzoyl-, Et ester, 497².
 1-Naphthoic acid, 8-xyloyl-, 497².
 Rosolic acid, 2710².
 C₂₀H₁₄O₄ Isophenolphthalin, 272².
 Oxindigo, 3,5,3',5'-tetramethyl-, 246⁴.
 Oxindirubin, 3,5,3',5'-tetramethyl-, 2046⁷.
 o-Toluic acid, α,α-bis(p-hydroxyphenyl)-, 2710².
 C₂₀H₁₄O₄ Chromone, 7-hydroxy-2-methyl-3-piperonyl-, acetate, 2653¹.
 Fumaric acid, diphenacyl-, 63².
 Maleic acid, diphenacyl-, 63².
 C₂₀H₁₄O₄ Anthraquinone, 1,8-dihydroxy-3-methoxy-6-methyl-, diacetate, 1860⁴.
 C₂₀H₁₄O₃ Benzil, 2,4,6-trihydroxy-, triacetate, 2946².
 C₂₀H₁₄BrN Desoxybenzoin, p-bromophenylhydrazine-, 2204².
 C₂₀H₁₄BrN₂O Hydrazine, α-(p-bromophenyl)-β-diphenylacetyl-, 1254⁴.
 C₂₀H₁₄Br₂NO₇ Indophenol, 6,7-dibromo-5,2'-dihydroxy-2,5'-dimethyl-, triacetate, 2649².
 C₂₀H₁₄N 9-Fluorylamine, N-p-tolyl-, 2658¹.
 C₂₀H₁₄NO Benzophenone, p-methyl-p'-phenyl-, oxime, 2045².
 C₂₀H₁₄NOS Benzanilide, o'-(benzylmercapto)-, 1423².
 C₂₀H₁₄NO₂ Anthranilic acid, N-phenyl-N-p-tolyl-, and Na salt, 511².
 Benzanilide, o-benzoyloxy-, 1423².
 Phenol, o-benzyl-, carbanilate, 2038².
 C₂₀H₁₄NO₃S Naphthylamine, naphthalenesulfonate, 650⁷.
 C₂₀H₁₄NO₄ (See also Berberine.)
 Δ^{1,2}-3-Heptatrienone, 1-p-anisyl-7-(nitrophenyl)-, 1266², 1268⁴.
 C₂₀H₁₄NO₂ Oxyberberine, 1710², 2958².
 Quinaldine, 2-anisal-, oxalate, 1267⁴.
 C₂₀H₁₄N₂O₂ Hydrazine, α-diphenylacetyl-β-(nitrophenyl)-, 1254⁴.
 C₂₀H₁₄N₂O₂ Anthracene, 1,2,3,4-tetrahydro-, picrate, 1272².
 Phenanthrene, 1,2,3,4-tetrahydro-, picrate, 1274².
 C₂₀H₁₄N₂O₃ Carbanilide, p-methylthio-, picrate, 1411⁷.

- $C_{20}H_{11}$ 1,1'-Binaphthyl, 3,4,3',4'-tetrahydro-, 2201¹.
- $C_{20}H_{11}As_2O_4$ Arsanilic acid, *N*-[(aminobenz-amido)benzoyl]-, 979^{4,5,6}.
- $C_{20}H_{11}BNO_4$ Anthraquinone, 2-amino-1-hydroxy-, boracetate, 2202¹.
- $C_{20}H_{11}BrNO_4$ Chelidonine, bromo-, 830¹.
- $C_{20}H_{11}Br_2$ $\Delta^1,1'(3,2')$ -Binaphthyl, 2,3'-dibromo-3,4,3',4'-tetrahydro-, 2201¹.
- $C_{20}H_{11}Br_2O_4$ 2(1) - Benzofuranone, 4,6 - dibromo - 3,5 - dimethoxy - 1 - (3,4,5-trimethoxybenzoyl)-, 2207¹.
- $C_{20}H_{11}Br_2O$ Cyclohexanone, 2,6-dibromo-2,6-bis-(α -bromobenzal)-, 2941¹.
- $C_{20}H_{11}Br_2O_2$ 2(1) - Benzofuranone, 1,4,6-tribromo - 1 - (α - bromo - 3,4,5 - trimethoxybenzyl) - 3,5 - dimethoxy-, 2207¹.
- $C_{20}H_{11}ClNO_4$ Isocarbostryl, 3-chloro-2-homopiperonyl-6,7-dimethoxy-, 2959¹.
- $C_{20}H_{11}CuO_4$ Acrylophenone, β -hydroxy - α - methoxy-, Cu^+ salt, 2342¹.
- $C_{20}H_{11}IN$ 1-Methyl 2(and 4)-(α -phenylstyryl)-pyridinium iodide, 2498¹.
- $C_{20}H_{11}N_2O$ Hydrazine, α -diphenylacetylphenyl-, 1253¹, 1254¹.
- $C_{20}H_{11}N_2O_2$ Quinone, 2,5-bis(benzylamino)-, 259¹.
- $C_{20}H_{11}N_2O_3S$ Acetan, 1-*p*-tolylsulfonamido-5- γ -Isobenzophenothiazone, 9-diethylapino-6-hydroxy-, 513¹.
- $C_{20}H_{11}N_2O_4$ Berberine, imino-, and -HCl, 2950¹, 2,5-Piperazinedione, 1,4-dibenzyl-, 995¹.
- $C_{20}H_{11}N_2S$ Pyridine, 1,2(and 1,4)-dihydro-1-methyl - 2(and 4) - [α - (phenylthiocarbonyl)benzal]-, 2498¹.
- Urea, thiotriphenylmethyl-, 2479¹.
- $C_{20}H_{11}N_2O$ Benzophenone, δ -anilinosemicarbazone, 482¹.
- Glyoxylanilide, α -anilino-, phenylhydrazone, 437¹.
- $C_{20}H_{11}N_2O_2$ 1,4-Butanedione, 1,4-diindyl-, di-oxime, 2493¹.
- $C_{20}H_{11}N_2O_4$ 1,7-Indandione, 2,2'-ethylidenbis-, tetraoxime, 23486¹.
- $C_{20}H_{11}O_4$ Benzyl alcohol, *o*(*p*, *p'*) - dihydroxybenzohydryl-, 2710¹.
- 1,2' - Bibenzofuran - 2(1) - one, 3,5,3'5'-tetramethyl-, 2046¹.
- Cyclohexanone, 2,6-bis(*p*-hydroxybenzal)-, -HBr, 1415¹.
- Δ^1 -Cyclohexenone, 3-(*o*-hydroxystyryl)- β -salicyl-, 484¹.
- $C_{20}H_{11}O_4$ 1,1'-Bi-2-benzofuranol, 3,5,3',5'-tetramethyl-, 2046¹.
- Coumarin, 3,4 - dihydro - 4 - (*o*-methoxycinnamylmethyl)-, 486¹.
- Dimethyl ether, m. 191⁰, of compd. from 2-methyl-5-benzofuranol, 2665¹.
- $C_{20}H_{11}O_4$ Compd., m. 166¹, from decalin and pyromellitic anhydride, 1275¹.
- $C_{20}H_{11}BrN_2O$ 2-Naphthol, 1 - (5 - bromo - 2 - carvacrylazo)-, 641¹.
- $C_{20}H_{11}BrN_2O_4S$ Naphtholsulfonic acid, (5-bromocarvacrylazo)-, 641¹.
- $C_{20}H_{11}BrN_2O_4S_2$ 2,7-Naphthalenedisulfonic acid, 3 - (5 - bromo - 2 - carvacrylazo)-4,5-dihydroxy-, 641¹.
- $C_{20}H_{11}Br_2NO_4$ Codeinone, dibromohydroxy-, acetate, 298¹.
- $C_{20}H_{11}IN_2O_4$ 1-Ethyl - 8 - methoxy - α - (*m*-nitrobenzal)quinolidium iodide, 2668¹.
- $C_{20}H_{11}IN_2S$ Thioisocyanine, 1'-ethyl-2-methyl-, iodide, 289¹.
- Isoisocyanine, 1'-ethyl-2-methyl-, iodide, 289¹.
- $C_{20}H_{11}N$ Dibenzylamine, *N*-phenyl-, 15¹.
- Ethylamine, β -triphenyl-, -HCl, 282¹.
- Naphthocarbazole, hexahydro-, 173¹.
- $C_{20}H_{11}NO$ *p* - Anisidine, *N* - (*p*-phenyl- $\Delta^1,1'$ -heptatrienylidene)-, 2941¹.
- Benzohydroxy, α -(α -aminobenzyl)-, 1138¹; -HCl, 635¹.
- $C_{20}H_{11}NO_2$ Cinchophen, Bu ester, -III, 75¹.
- Coumarin, 4 - (*p*-dimethylaminostyryl) - 7-methyl-, 2485¹.
- $\Delta^1,1'$ - 3 - Heptatrienone, 7-(*m*-aminophenyl) - 1 - *p* - anisyl-, and salts, 1268¹.
- 2-Quinolineethanol, 8-methoxy- α -styryl-, and -HCl, 2668¹.
- $C_{20}H_{11}NO_2$ Compd. from 7-methoxylepidine and 3,4-(MeO) C_6H_3CHO , -HCl, 292¹.
- Compd. from 4-methoxy-2-methylquinoline and piperonal, -HCl, m. 174-6⁰, 520¹.
- Compd. from 7-methoxyquinoline and 3,4-(MeO) C_6H_3CHO , -HCl, 293¹.
- $C_{20}H_{11}NO_4$ 1,3(2,4) - Isoquinolinedione, 2 - homopiperonyl-4,4-dimethyl-, 2958¹.
- 7-Isoquinolinol, 6-methoxy-1-(α -methylcyclohexatryl)-, and salts, 2669¹.
- Palmatrubine, and salts, 250¹.
- Pseudoberberine, dihydro-, 2669¹.
- $C_{20}H_{11}NO_4S_2$ 6,1,5-Thiopyranopyridine-3-carboxylic acid, 4-*p*-anisyl - 1,7 - dihydro-5,7-diketol-1,2-dimethyl-7-thio-, Et ester, 2497¹.
- $C_{20}H_{11}NO_4$ Chelidonine, 831¹.
- Papaveraldrone, 520¹, 2669¹.
- $C_{20}H_{11}NO_4$ Di-2,5-cresotamide, diacetate, 52¹.
- 1,3(2,4) - Isoquinolinedione, 2 - homopiperonyl-6,7-dimethoxy-, 2959¹.
- Quinoline, 3 - methoxy - 6,7 - methylenedioxy - 2 - (3,4,5 - trimethoxyphenyl)-, 1141¹.
- $C_{20}H_{11}N_2O_4S$ Benzenesulfonic acid, [*N*-ethyl-anilino(phenylazo)-], 515¹.
- $C_{20}H_{11}N_2O_4$ 1,2,5-Triazole-3-*o*-benzoic acid, 4-carboxy-1-phenyl-, di-Et ester, 1865¹.
- $C_{20}H_{11}N_2OPS$ Thiophosphate dihydrazide, Ph ester, dibenzal deriv., 2326¹.
- $C_{20}H_{11}OPS$ Thiophosphoric acid, Ph di-*p*-tolyl ester, 2325¹.
- $C_{20}H_{11}$ Naphthalene, 2-*o*-phenylbutyl-, 1271¹.
- $C_{20}H_{11}AgClIN_4O_4$, 1526¹.
- $C_{20}H_{11}BNO_4$ Dipyrrocatecholboric acid, *N*, *N*-dimethylarginine salt, 2178¹.
- $C_{20}H_{11}BrNO_4$ Codeinone, bromohydroxy-, acetate, 298¹.
- $C_{20}H_{11}Br_2NO_4$ Codeinone, tribromodihydroxy-, acetate, 298¹.
- $C_{20}H_{11}ClNO_4$ 2 - (*p* - Dimethylaminostyryl)-7-hydroxy - 4 - methylbenzopyrylium chloride, 1707¹.
- $C_{20}H_{11}Cl_2SnN_4O_4$, 2173¹.
- $C_{20}H_{11}ClO_4$ Cyclohexanone, 2,6-bis(*p*-chlorobenzyl)-, 2941¹.
- $C_{20}H_{11}Cl_2MnN_4$, 2174¹.
- $C_{20}H_{11}INO_4$ 4-Methoxy-2-(*p*-methoxystyryl)quinolinium iodide, 1279¹.
- $C_{20}H_{11}N_2O$ Cyclohexanone, 2,6-bis(aminobenzal)-, and -HCl, 1266¹, 1267¹.
- Cyclopentanecarboxylic acid, naphthylheaminetrimethyl-, diazole, 2494¹.
- $C_{20}H_{11}N_2O_4$ Barbituric acid, 5-ethyl-5-phenethyl-1-phenyl-, 471¹.
- $C_{20}H_{11}N_2O_4S_2$ 1,6-Pyridopyridine - 3 - carboxylic acid, 1,5,6,7 - tetrahydro 5,7 - diketol-

- 1,2,4-trimethyl-6-phenyl-7-thio-, Et ester, 2497^a.
- 1,6-Pyridopyridine-3-carboxylic acid, 5,6,7-tetrahydro-5,7-diketo-1,2,4-trimethyl-6-phenyl-, Et ester, 2497^a.
- $\text{C}_{20}\text{H}_{20}\text{N}_2\text{O}_3$: Codeinone, cyanonoracetyldihydroxy-, 299^a.
- $\text{C}_{20}\text{H}_{20}\text{N}_2\text{O}_5$: 1-Naphthol-3-sulfonic acid, 7-(*p*-acetylethylamino-anilino-), P 403⁷.
- $\text{C}_{20}\text{H}_{20}\text{N}_2\text{O}_6$: Berberine, tetrahydro-6-nitro-, 2669^a. Succinic acid, *N*, *N'*-*p*-biphenylenebis-, 2196^a.
- $\text{C}_{20}\text{H}_{20}\text{N}_2\text{O}_7$: Oxindole, 5-ethoxy-1,3-dimethyl-3-vinyl-, picrate, 1140^a.
- $\text{C}_{20}\text{H}_{20}\text{N}_2\text{O}_8$: 1,3,4-Thiadiazole, 2,2'-dithiobis-[4,5-dihydro-5-xylylimino-, 988^a.
- $\text{C}_{20}\text{H}_{20}\text{O}_2$: Diphenoquinone, diallyldimethyl-, 271^a.
- $\text{C}_{20}\text{H}_{20}\text{O}_3$: Benzoic acid, *o*-(*p*-cyclohexylbenzoyl)-, 2950^a.
- $\text{C}_{20}\text{H}_{20}\text{O}_4$: Chromone, 7-methoxy-2-methyl-3-veratryl-, 2653^a, c.
- $\Delta^{1,4}$ -3-Pentadienone, 1,5-bis(4-hydroxy-*m*-anisyl)-1-methyl-, 2943^a.
- 2(3,9'-Spiro[furan-xanthen]-5(4)-one, 4,4-diethyl-3',6'-dihydroxy-, 986^a.
- 2,9'-Spiro[1,2-pyran-xanthen]-6(5)-one, 4-ethyl-3,4-dihydro-3',6'-dihydroxy-4-methyl-, 986^a.
- $\text{C}_{20}\text{H}_{20}\text{O}_5$: Acetic acid, benzoylveratroyl-, Et ester, 2955^a.
- $\text{C}_{20}\text{H}_{20}\text{O}_7$: 2(1-Benzofuranone, 3,5-dimethoxy-1-(3,4,5-trimethoxybenzyl)-, 2207^a.
- Citric acid, dibenzyl ester, and salts, P 2673¹.
- $\text{C}_{20}\text{H}_{20}\text{O}_8$: 3,6-Benzofurandione, 1,2-dihydro-4-(α -hydroxyveratryl)-5-methoxy-, acetate, 484^a.
- Flavone, 3-hydroxy-5,7,3',4',5'-penta-methoxy-, 2652^a.
- $\text{C}_{20}\text{H}_{20}\text{O}_{14}$: Hamameli tannin, 260^a.
- $\text{C}_{20}\text{H}_{20}\text{ClO}_4$: Compd. from 3,5,7-trimethoxy-coumarin, 655^a.
- 2-(Dimethoxyphenyl)-3,5,7-trimethoxybenzopyrylium chloride, and salts, 1141^a, 2341^a.
- $\text{C}_{20}\text{H}_{21}\text{IN}_2\text{O}_4$: ϵ -Ethyl- α -(α -hydroxy-*m*(and *o*)-nitrobenzyl)-8-methoxyquinaldinium iodide, 2668^a.
- $\text{C}_{20}\text{H}_{21}\text{IN}_2\text{S}$: Thiazole, 2-(*p*-dimethylaminostyryl)-5-phenyl-, methiodide, 1706⁷.
- $\text{C}_{20}\text{H}_{21}\text{NO}_3$: 3-Pentadienone, 1-*p*-anisyl-5-(*p*-dimethylaminophenyl)-, and salts, 1266^a.
- $\text{C}_{20}\text{H}_{21}\text{NO}_4$: Galipine, 520^a.
- Quinolif, (dimethoxyphenethyl) 7-methoxy-, 292^a, 293^a.
- $\text{C}_{20}\text{H}_{21}\text{NO}_4$ (See also *Papaverine*.) Codeinone, allylnorhydroxy-, -HI, 290^a.
- 4,1-3-Hexenol, 5-methyl-1-phenyl-, *p*-nitrobenzoate, 232^a.
- 7-Isoquinolinol, 6-methoxy-1-(α -methylveratryl)-, 2669^a.
- Pseudoberberine, tetrahydro-, 2668^a.
- Sapon. produq., m. 190-2^o, of carbethoxy-bulbocapnine-Me ether, 990^a.
- $\text{C}_{20}\text{H}_{21}\text{NO}_5$: 1,4-Benzopyran-3-carbamic acid, 4,8-dimethoxy-2-phenyl-, Et ester, 519^a.
- Isoquinolastyril, 2-(2,3-dimethoxybenzyl)-6,7-dimethoxy-, 2668^a.
- 6,7-dimethoxy-2-veratryl-, 2669^a.
- Isoquinoline, 3,4-dihydro-6,7-dimethoxy-1-veratroyl-, 2671^a.
- Papaveraldine, 3,4-dihydro-, and salts, 520^a.
- Veratryl alcohol, α -(7-hydroxy-4-methoxy-1-isquinolyl)- α -methyl-, 2669^a.
- $\text{C}_{20}\text{H}_{21}\text{NO}$: Cinnamic acid, 3,4,5-trimethoxy- α -(*N*-methylbenzoylido)-, 2652^a.
- $\text{C}_{20}\text{H}_{21}\text{NO}_2$: Veratric acid, 6-[(*N*-homopiperonyl-carbamyl)methyl]-, 2959^a.
- $\text{C}_{20}\text{H}_{21}\text{NO}_3$: 1,2-Benzopyran-3,4-dione, 5,7-dimethoxy-2-(3,4,5-trimethoxyphenyl)-, 3-oxime, 2652^a.
- $\text{C}_{20}\text{H}_{21}$: 2,2'-Binaphthyl, 1',2,3,4,5',6',7',8'-octahydro-, 1270^a.
- $\text{C}_{20}\text{H}_{21}\text{BrNO}_2$: 2-(2,3-Dimethoxybenzyl)-6,7-dimethoxyisoquinolinium bromide, 2668^a.
- 6,7-Dimethoxy-2-veratrylisoquinolinium bromide, 2669^a.
- Malonic acid, (α -*p*-bromoanilinobenzyl)-, di-Et ester, 1416^a.
- $\text{C}_{20}\text{H}_{21}\text{BrNO}_3$: Codeinone, bromodihydroxy-droxy-, acetate, 298^a.
- 2-Isoquinolinecarbinol, 1-(6-bromoveratryl)-1,2,3,4-tetrahydro-6,7-methylenedioxy-, 2669^a.
- $\text{C}_{20}\text{H}_{21}\text{BrNO}_4$: Codeinone, bromodihydrotri-hydroxy-, monoacetate, 298^a.
- $\text{C}_{20}\text{H}_{21}\text{ClNO}_6$: Malonic acid, (α -*p*-chloroanilino-benzyl)-, di-Et ester, 1416^a.
- $\text{C}_{20}\text{H}_{21}\text{INO}_2$: 2-(2,3-Dimethoxybenzyl)-6,7-dimethoxyisoquinolinium iodide, 2668^a.
- 6,7-Dimethoxy-2-veratrylisoquinolinium iodide, 2669^a.
- $\text{C}_{20}\text{H}_{21}\text{INO}_3$: 2-(2,3-Dimethoxybenzyl)-6,7-dimethoxyisoquinolinium periodide, 2668^a.
- $\text{C}_{20}\text{H}_{21}\text{N}_2$: 1(2)-Anthracenone, hexahydro- α -phenyl-hydrazone, 1273^a.
- $\text{C}_{20}\text{H}_{21}\text{N}_2\text{O}_2$ (See also *Gelsemine*.) Cyclopentanecarboxylic acid, naphthylene-amidinetrimethyl-, 2494^a.
- 1,2-Cyclopropanedicarbox-*p*-toluide, 1-methyl-, 1408^a.
- $\text{C}_{20}\text{H}_{21}\text{N}_2\text{O}_3$: 2(3,9'-Spiro[furan-xanthen]-5(4)-one, 3',6'-bisdimethylamino-, -HCl, 986^a.
- $\text{C}_{20}\text{H}_{21}\text{N}_2\text{O}_4$: Papaveraldine, 3,4-dihydro-, oxime, 520^a.
- $\text{C}_{20}\text{H}_{21}\text{N}_2\text{O}_5$: Benzamide, *N*, *N'*-2,3-butylenebis-, oxalate, 984^a.
- Dinicotinic acid, 1,2-dihydro-1,6-dimethyl-2-methylene-4-(*m*-nitrophenyl)-, di-Et ester, and perchlorate, 2497^a.
- Isoquinoline, 2-(2,3-dimethoxybenzyl)-1,2,3,4-tetrahydro-6,7-methylenedioxy-1-nitromethyl-, 2668^a.
- Malonic acid, (α -*m*-nitroanilinobenzyl)-, di-Et ester, 1415^a.
- $\text{C}_{20}\text{H}_{21}\text{N}_2\text{O}_4\cdot 3\text{H}_2\text{O}$: Benzidine, antimonyl tartrate, 1253^a.
- $\text{C}_{20}\text{H}_{21}\text{N}_2\text{O}_5$: Acridine, octahydro-10-*n*-ethyl-, picrate, 522^a.
- $\text{C}_{20}\text{H}_{21}\text{N}_2\text{O}_6$: Etheseroline, picrate, 1140^a.
- $\text{C}_{20}\text{H}_{21}\text{O}$: 1(2)-Naphthalenone, 3,4-dihydro-6(or 7)-phenylbutyl-, 1271^a.
- γ -Pentenophenone, α -benzyl- α -ethyl-, 1134^a.
- $\text{C}_{20}\text{H}_{21}\text{O}_2$: 1,1'(2,2')-Bi-1-naphthol, 3,4,3',4'-tetrahydro-, 2201^a.
- $\text{C}_{20}\text{H}_{21}\text{O}_4$: 6,6'-Bi-2,4-xylenol, diacetate, 1251^a.
- 1,4-Butanedione, 1,4-bis(6-hydroxy-2,4-xylyl)-, 2046^a.
- 3-Hexanol, 1-phenyl-, acid phthalate, 2330^a.
- 3-Hexanone, 1-(8-hydroxy-*m*-anisyl)-, benzoate, 2944^a.
- 1,4-Pyrone, 2,6-di-*p*-anisyl-2,3,5,6-tetrahydro-3-methyl-, 467^a.
- Succinic acid, di-3,5-xylyl ester, 2046^a.
- $\text{C}_{20}\text{H}_{21}\text{O}_5$: Chalcone, 2,4,6,3',4'-pentamethoxy-, 1260^a.

- C₂₀H₂₁O₇** 2(1)-Benzofuranone, 3,5-dimethoxy-1-(3,4,5-trimethoxybenzyl)-, 2207¹.
 Chalcone, hydroxy pentamethoxy-, 2207¹, 2652⁴.
 Flavanone, 5,7,3',4',5' pentamethoxy-, 2207¹, 2052⁵.
 Trimellitic acid, 5-(decahydro-2-naphthoyl)-, 1275¹.
C₂₀H₂₁N Camphor, naphthylamino-, 935⁴.
C₂₀H₂₁NO 1(2)-Naphthalene, 3,4-dihydro-6(or 7)-phenylbutyl-, oxime, 1271⁴.
C₂₀H₂₁NO₂ Aniline, *N*-cinnamal-4,5-dimethoxy-2-propyl-, and -HCl, 2474⁷.
C₂₀H₂₁NO₂S 9-Phenanthrenesulfonamide, 1,2,3,4,5,6,7,8-octahydro-, 1274⁷.
C₂₀H₂₁NO₂S Aniline, *N*,*N*-diethyl-, naphthalenesulfonate, 650⁹.
C₂₀H₂₁NO₄ Codeinone, allylnordihydroxy-, -HBr, 299⁹.
 Dinicotinic acid, 1,2-dihydro-1,6-dimethyl-2-methylene-4-phenyl-, di-Et ester, and perchlorate, 2497¹.
C₂₀H₂₁NO₄ Isocarbostryl, 3,4-dihydro 6,7-dimethoxy-2-veratryl-, 2669³.
 —, 2-(2,3-dimethoxybenzyl)-3,4-dihydro-6,7-dimethoxy-, 2668⁷.
 1-Isoquinolinol, 1,2-dihydro-6,7-dimethoxy-2-veratryl-, 2669³.
 —, 2-(2,3-dimethoxybenzyl)-1,2-dihydro-6,7-dimethoxy-, and chlorostannane, 2668⁸.
C₂₀H₂₁NO₅ Butyric acid, α -(α -carbamy- α -hydroxy- γ -phenylpropoxy)- α -hydroxy- γ -phenyl-, 3265².
 Hydrocinnamic acid, 3,4,5-trimethoxy- α -(*N*-methylbenzamido)-, 2652¹.
C₂₀H₂₁N₂O α -Pentenophenone, *p*-(*p*-dimethylaminophenylazo)- γ -methyl-, 2474⁸.
C₂₀H₂₁N₂O₂ 2(1)-Benzofuranone, 3,5-dimethoxy-1-veratryl-, semicarbazone, 2041⁸.
C₂₀H₂₁ Naphthalene, 1,2,3,4-tetrahydro-6-phenylbutyl-, 1270⁹.
C₂₀H₂₁BrN₂O₄ Fructose, (*p*-bromophenyl)-methylsazone, 45⁴.
C₂₀H₂₁Br₂O₄ Propane, 1,2-dibromo-1-(3,4-dimethoxyphenyl)-1-(2,4,6-trimethoxyphenyl)-, 2939⁷.
C₂₀H₂₁ClNO 3,4-Dihydro-6,7-dimethoxy-2-veratrylisoquinolinium chloride, 2669³.
C₂₀H₂₁INO₄ 3,5-Dicarbethoxy-1,2,6-trimethyl-4-phenylpyridinium iodide, 2497³.
 3,4-Dihydro-6,7-dimethoxy-2-veratrylisoquinolinium iodide, 2669³.
 2-(2,3-Dimethoxybenzyl)-3,4-dihydro-6,7-dimethoxyisoquinolinium iodide, 2668⁷.
C₂₀H₂₁INO₄ 3,4-Dihydro-6,7-dimethoxy-2-veratrylisoquinolinium periodate, 2669³.
C₂₀H₂₁N₂O₂ (See also *Quinidine*; *Quinine*.)
 Addn. compd., hydroquinol and benzylamine, 259¹.
p-Glutarotoluide, α -methyl-, 2477².
C₂₀H₂₁N₂O₂S Acetanilide, *o,o'*-dithiobis[*N*-ethyl-, 2330⁹.
 Isobutyramide, *ar',ar''*-dithiobis-, 816¹.
C₂₀H₂₁N₂O₂ 7-Isoquinolinol, 1,2,3,4-tetrahydro-6-methoxy-1-(α -methylveratryl)-2-nitroso-, 2669³.
 3,4-Pyrroledicarboxylic acid, 1-(*p*-acetamidophenyl)-2,5-dimethyl-, di-Et ester, 278⁸.
C₂₀H₂₁N₂O₂ Dinicotinic acid, 1,2-dihydro-1,2,6-trimethyl-4-(*m*-nitrophenyl)-, di-Et ester, 2497¹.
C₂₀H₂₁N₂O₂ Addn. compd., m. 120-2⁹, of anthranilic acid and 1,4-dimethyl-2,5-piperazinedione, 2033².
C₂₀H₂₁O₂ Diphenodiquinone, 3,3'(or 6,5')-dimethyl-5,5'(or 5,3')-dipropyl-, 271².
 —, 3,3',5,5'-tetraethyl-, 271².
C₂₀H₂₁O₂ Cyclohexanol, 2,6-bis(*p*-hydroxybenzyl)-, 1415².
C₂₀H₂₁O₄ Naphthalic acid, *di-Et* ester, 497².
C₂₀H₂₁O₄ Propene, 1-(3,4-dimethoxyphenyl)-1-(2,4,6-trimethoxyphenyl)-, 2939⁷.
C₂₀H₂₁O₄ Propiophenone, 3,4-dimethoxy-2-(2,4,6-trimethoxyphenyl)-, 1260⁹.
C₂₀H₂₁O₇ Propiophenone, 2-hydroxy-4,6-dimethoxy- β -(3,4,5-trimethoxyphenyl)-, 2207¹.
C₂₀H₂₁NO₂ Benzanide, *N*-[α -(diethylhydroxymethyl)phenethyl]-, 635⁹.
C₂₀H₂₁NO₂ Δ^2 -1-Propenol, 1-(4,5-dimethoxy-2-propylanilino)-3-phenyl-, and -HCl, 2474⁷.
C₂₀H₂₁NO₂ Dinicotinic acid, 1,2-dihydro-1,2,6-trimethyl-4-phenyl-, di-Et ester, 2497¹.
 Isoquinoline, 2-(2,3-dimethoxybenzyl)-1,2,3,4-tetrahydro-6,7-dimethoxy-, and chlorostannane, 2668⁸.
 —, 1,2,3,4-tetrahydro-6,7-dimethoxy-2-veratryl-, 2669³.
 7-Isoquinolinol, 1,2,3,4-tetrahydro-6-methoxy-1-(α -methylveratryl)-, 2669³.
 Laudanidine (Tritopine), 1574⁴, 2958⁸.
 Laudanine, 1574⁴.
C₂₀H₂₁NO₄ 1-Isoquinolinol, 2-(2,3-dimethoxybenzyl)-1,2,3,4-tetrahydro-6,7-dimethoxy-, and ZnCl₂ salt, 2668⁷.
 —, 1,2,3,4-tetrahydro-6,7-dimethoxy-2-veratryl-, 2669³.
C₂₀H₂₁NO₅ Propiophenone, 3,4-dimethoxy- β -(2,4,6-trimethoxyphenyl)-, oxime, 1260⁹.
C₂₀H₂₁N₂O Quinine-amine, and $\cdot H_2SO_4$, 2055².
C₂₀H₂₁N₂O₂ Quinine, oxime, 2055².
C₂₀H₂₁INO₂ Compd. from cyanonortebenine 2830¹.
C₂₀H₂₁N₂ Aniline, *p,p'*- Δ^1 -butenyldigenebis[*N*,*N*-dimethyl-, 267⁴.
C₂₀H₂₁N₂O Caprophenone, *p*-methoxy-, phenylhydrazine, 267¹.
C₂₀H₂₁N₂O₂ Aniline, *N*-(*p*-dimethylaminobenzal) 4,5-dimethoxy-2-propyl-, and -HCl, 2474⁷.
 Hydroquinidine, 1425⁶.
 Hydroquinine, 1425⁶.
C₂₀H₂₁N₂O₃ 3,3'-Biindazole, 2,2'-diacetyl-4,5,6,7,4',5',6',7'-octahydro-7,7'-dimethyl 1263³.
C₂₀H₂₁N₂O₃ Butyraldehyde, β -amino-, di-Et acetal, picrate, 2343³.
C₂₀H₂₁N₂S₂ Formamidine, *C,C'*-ethylenedithio bis[*N*-ethyl-*N'*-phenyl-, and salts, 2481⁴.
C₂₀H₂₁O₄ 4,4'-Bi-*o*-cresol, 5,6'-dipropyl-, 271².
C₂₀H₂₁O₄ Propane, 1-(3,4-dimethoxyphenyl)-1 and 3)-(2,4,6-trimethoxyphenyl)-, 2939⁷.
 Veratrole, 4- γ -(2,4,6-trimethoxyphenyl)propyl-, 2041⁸.
C₂₀H₂₁NO₂ Compd. from codeinone, and -HI, 297².
C₂₀H₂₁N₂O₂ Des-*N*-methyl-dihydrocannabinol, 2827¹.
C₂₀H₂₁NO₂ Diversine, 1708⁹.
C₂₀H₂₁NO₂ + 3H₂O See *Amygdalin*.
C₂₀H₂₁N₂O Quinotoxine-amine, and salts, 2055².
 Semicarbazide, 2-heptyl-2,4-diphenyl-, 3478¹.
C₂₀H₂₁ Compd., b.p. 180-205⁹, from *d*-methyl pimaric, 648⁹.

- C₂₀H₂₃BrNO₈ Kairolone, *d-r*- α -bromocamphor-sulfonate, 510⁷.
- C₂₀H₂₃INO₈ Methiodide of methyl ether of compd. from codeinone, 297³.
- C₂₀H₂₃INO₈ Des-*N*-methylhydrocodeinone, dihydro- α -methiodide, 2827¹.
- C₂₀H₂₃N₃O₈ 1-Propanesulfonic acid, 1-(*p*-phenylcarbamyl)-, *p*-phenetidine salt, 37⁷.
- C₂₀H₂₃N₄ s-Tetrazine, hexahydro-1,4(or 1,5)-disopropyl-2,5(or 2,4)-diphenyl-, 642⁸.
- C₂₀H₂₃N₄O₈ 1,2,3,4-*v*-Tetrazinetetracarboxylic acid, hexahydro-5-phenyl-, tetra-Et ester, 1425⁷.
- C₂₀H₂₃O₈ l-Amygdalinic acid, 73¹.
- C₂₀H₂₃O₈ Pimaric acid, methyl-, 648⁸.
- C₂₀H₂₃BrNO₈ Aniline, *N,N*-diethyl-, *d-r*- α -bromocamphorsulfonate, 510⁷.
- C₂₀H₂₃INO₈ Des-*N*-methylhydrothebaine, dihydro-, methiodide, 2827¹.
- *C₂₀H₂₃N₂O₈ Malonic acid, acetylisobutyl-, di-Et ester, *p*-nonylhydrazone, 3480⁸.
- C₂₀H₂₃O₈ (See also *Abietic acid*.)
Alepic acid, 53²⁰.
 β -Decenic acid, δ,δ -dimethyl- α -phenyl-, Et ester, 2030⁸.
Densipimaric acid, 2501⁸.
Pimaric acid, 648⁸.
- C₂₀H₂₃N₂O₈ Terephthalic acid, 2-nitro-, diethylaminoethyl ester, 1700⁸.
- C₂₀H₂₃Cl₂MnN₂, 1385⁴.
- C₂₀H₂₃Cl₂MnN₂, 1385⁴.
- C₂₀H₂₃Cl₂MnN₂, 1385⁴.
- C₂₀H₂₃N₂ 2-Butanone, α -(3,7-dimethyl- Δ^7 -octenyl)- α -phenylhydrazone, 2029⁷.
Camphenilone, β -methyl-, azine, 2945⁸.
- C₂₀H₂₃O₈ Arachidonic acid, 3297¹.
- C₂₀H₂₃O₈ Monohydroxy acid, m. 230°, from abietic acid, 3349².
- C₂₀H₂₃N₂O₈ Myristaldehyde, *p*-nitrophenylhydrazone, 3261⁸.
- C₂₀H₂₃N₂O₈ Terephthalic acid, 2-amino-, diethylaminoethyl ester, and *d-HCl*, 1700⁸.
- C₂₀H₂₃Cl₂N₂O₈ Piperazine, 1,4-bis(chloroacetyl)-leucyl-, 2830⁸.
- C₂₀H₂₃O₈ Compd. from the reduction of *d*-Arbanone, m. 211-2°, 52⁹.
- C₂₀H₂₃HgO₈ Chloromeric acid, ethoxy(hydroxy-mercuri)-, anhydride, 971⁸.
- C₂₀H₂₃N₂O₈ Piperazine, 1,4-bis(glycylleucyl)-, 2830⁸.
- C₂₀H₂₃O₈ Isogadoleic acid, and Ag salt, 2930⁸.
Oleic acid, ethyl ester, 339²⁰.
Oleic alcohol, acetate, 468⁷.
- C₂₀H₂₃O₈ Capric anhydride, 3081⁴.
- C₂₀H₂₃O₈ d-Glucose, galactoside octamethyl deriv., 2813¹.
Isotrehalose, octamethyl deriv., 2813¹.
Melibiose, octamethyl deriv., 2813¹.
- C₂₀H₂₃N₂O₈ Glycine, *N*-palmityl-, Et ester, 2051⁷.
- C₂₀H₂₃O₈ Eicosanone, 1692⁷, 2807¹.
- C₂₀H₂₃O₈ See *Arachidic acid*; *Eicosanic acid*.
- C₂₀H₂₃O₈ Stearic acid, β -hydroxy-, Et ester, 2027⁷.
- C₂₀H₂₃NO₈ Acetamide, octadecyl-, 759⁸, 1127⁸.
- C₂₀H₂₃O₈ Eicosane, 1692⁷.
- C₂₀H₂₃O₈ 1-Eicosanol, 1127⁸.
- C₂₀H₂₃N₂O₈ Eicosylamine, -HCl, 1127⁸.
- C₂₀H₂₃Cl₂ Germanium, tetraisocamyl-, 2473⁸.
- C₂₀H₂₃Cl₂Co₂N₂O₈, 67⁸.
- C₂₀H₂₃Cl₂N₂O₈ 2 - Anthraldehyde, 5,6,7,8-tetrachloro-9,10-dihydro-9,10-diketo-1-pitro-, phenylhydrazone, 2045⁸.
- C₂₀H₂₃Cl₂N₂O₈ 2 - Anthraldehyde, 5,6,7,8-tetrachloro-9,10-dihydro-9,10-diketo-, phenylhydrazone, 2046¹.
- C₂₀H₂₃Cl₂N₂O₈ Addn. compd., m. 132-3°, of acenaphthene and perchloroindone, 1258⁴.
- C₂₀H₂₃O₈ 6-*m*- β -Benzodindene-carboxylic acid, 5,12-diketo-, 494⁸.
- C₂₀H₂₃Cl₂N₂O₈ α,α' -Dibenzofluorene, 13,13-dichloro-, 1860^{1,4}.
- C₂₀H₂₃N₂O₈ 6(2)-Anthrapyrazolone, 2-benzoyl-, 1275¹.
- C₂₀H₂₃N₂O₈ Oxindole[Δ^8,Δ^9]rhodanine, 3' - [1 (and 2)-naphthyl]-, 1423¹.
- C₂₀H₂₃N₂O₈ Phenanthroxazole, 2-[*m*(and *p*)-nitrophenyl]-, 2335⁸.
- C₂₀H₂₃N₂O₈ Phenanthrenequinone, (*m*-nitrobenzalmino)-, 2491⁸.
- C₂₀H₂₃N₂O₈ Oxazole, 2,4,5-tris(*p*-nitrophenyl)-, 2667¹.
- C₂₀H₂₃Cl₂N₂O₈ α,α' -Dibenzofluorene, 13-chloro-, 1860¹.
- C₂₀H₂₃NO₈ Phenanthroxazole, 2-salicyl-, 2335⁸.
- C₂₀H₂₃N₂O₈ Phenanthrimidazole, 2-(*o*-nitrophenyl)-, 2335⁸.
- C₂₀H₂₃N₂O₈ 2 - Anthraldehyde, 9,10-dihydro-9,10-diketo-1-nitro-, phenylhydrazone, 2045⁸.
- Phenanthrenequinone, amino(*m*-nitrobenzalmino)-, 2491⁸.
- C₂₀H₂₃N₂O₈ Imidazole, 2,4,5-tris(*p*-nitrophenyl)-, 2494⁴.
- C₂₀H₂₃ α,α' -Dibenzofluorene, 1850⁸.
- C₂₀H₂₃BrCl₂N₂O₈ + 0.5 H₂O, 1-(1,5-dichloro-10-hydroxy-9-anthryl)pyridinium bromide, acetate, 2490⁸.
- C₂₀H₂₃Cl₂N₂O₈ *m*-Benzotoluide, 5'-chloro-6'-hydroxyido-, iodobenzoate, 1562¹.
- C₂₀H₂₃Cl₂N₂O₈ *m*-Benzotoluide, 5'-chloro-6'-hydroxy-2-nitro-, nitrobenzoate, 1562¹.
Compd., m. 241-2°, from 5'-chloro-6'-hydroxy-3,5-dinitro-*m*-benzotoluide and BzCl, 1562¹.
- C₂₀H₂₃Cl₂N₂O₈ Quinoxaline, 1,4-*endo*-keto-2,2-dichloro-3,3-diphenyltetrahydro-, 1425¹.
- C₂₀H₂₃Cl₂N₂O₈ *m*-Benzotoluide, 2,5'-dichloro-6'-hydroxy-, *p*-chlorobenzoate, 1562¹.
- C₂₀H₂₃N₂O₈ Phenanthrimidazole, 2-phenyl-, 2335⁸.
- C₂₀H₂₃N₂O₈ Quinoxaline, 1,4-*endo*-keto-2,2-keto-3,3-diphenyltetrahydro-, 1425¹.
- C₂₀H₂₃N₂O₈ Anthraquinone, 1(and 2)-(β)-benzoylhydrazino)-, 1275¹.
- Benzanilide, 4'-cyano-2'-hydroxy-, benzoate, 2340⁸.
- 1,4-Imidazopyridin-2-ol, 3-benzoyl-, benzoate, 1275¹.
- 7-iso-1,7-pyrrolopyridin-3-ol(?), di-Bz deriv., 281⁷.
- Oxazole, (*p*-nitrophenyl)diphenyl-, 2667¹.
- Phenanthrenequinone, 2-amino-7-salicylal-amino-, 2491⁸.
- 1,7-Pyrrolopyridin-3-ol(?), di-Bz deriv., 281⁷.
- C₂₀H₂₃N₂O₈ Phenanthrenequinone, 2-amino-7-(2,4-dihydroxybenzalmino)-, 2491⁸.
- C₂₀H₂₃N₂O₈ Acenaphthopyridine, picrate, 2662⁸.
- C₂₀H₂₃O₈ 7-Acenaphthenone, 8-cinnamal-, 821⁸.
Indone, 2,3-diphenyl-, 2208⁸.
Ketone, di-1-naphthyl-, 1861¹.
- *C₂₀H₂₃O₈ 1-Anthraic acid, Ph ester, 500⁸.
- C₂₀H₂₃O₈ 1(2)-Benzofuranone, 2-benzoyl-2-phenyl-, 1277¹.
- Ketone, bis(4-hydroxy-1-naphthyl), P 2831¹.
- C₂₀H₂₃O₈ 3-Isoxanthone, 9-(*p*-hydroxyphenyl)-, acetate, 649⁸.

- Umbelliferone, 4-methyl-, 2-naphthoate, 619^a.
- C₂₁H₁₁O₄ Pyrogallolcoumarin, 2197^a.
- C₂₁H₁₁O₁₀ Emulic acid, triacetate, 1880^r.
- C₂₁H₁₁Br₂N₂O₂ + H₂O, *o*-Cresolbenzein, dibromo-, 271^a.
- C₂₁H₁₁ClO 2,4-Diphenylbenzopyrylium chloride, *FeCl₃ compd.*, 287^a.
- C₂₁H₁₁ClO₂ 1,3-Thioxol-4(5)-one, 2-(chlorophenyl)-5,5-diphenyl-, 652^a.
- C₂₁H₁₁ClO₂ 2,4-Diphenylbenzopyrylium perchlorate, 287^a.
- C₂₁H₁₁NO Oxazole, 2,4,5-triphenyl-, 2667¹.
- C₂₁H₁₁NO₂ Oxazole, (*p*-hydroxyphenyl)diphenyl-, 2667¹.
- C₂₁H₁₁NO₂ 1,3-Thioxol-4(5)-one, 2-(*p*-nitrophenyl)-5,5-diphenyl-, 652^a.
- C₂₁H₁₁N₂O₂ 1,3,4-Thiadiazole, 3-benzoyl-2,3-dihydro-5-phenyl-2-phenylimino-, 2053².
- 1,2,4-Triazoline, 1-benzoyldiphenyl-5-thio-, 2053².
- Uretine, 2-phenyl-3-(*N*-phenylbenz-amido)-4-thio-, 2053².
- C₂₁H₁₁N₂O₂ Imidazole, 2-(*m*-nitrophenyl)-4,5-diphenyl-, 2494².
- 2,4(1,3)-Quinoxalinedione, 3-diphenylmethylenamino-, 1130^a.
- C₂₁H₁₁N₂O₂ *o*-Toluidine, α -benzal-*N*-benzoyl-4,6-dinitro-, 491^a.
- C₂₁H₁₁N₂O₇ Phenanthrene, 9-methyl-, picrate, 499^a.
- C₂₁H₁₁ Indene, 1,3-diphenyl-, 826^a.
- Methane, α -naphthylmethylidene-, 3147^a.
- Propadiene, 1,1,3-triphenyl-, 826^a, 1410^r.
- C₂₁H₁₁Br₂O₂ *o*-Cresolbenzein, dibromo-, 271^a.
- C₂₁H₁₁N₂ Pyrazole, 1,3,4-triphenyl-, 2822^a.
- Quinoxaline, 2-benzyl-3-phenyl-, 1419^a.
- C₂₁H₁₁N₂O Imidazole, 2-(*m*-hydroxyphenyl)-4,5-diphenyl-, 2494².
- Oxazole, (*p*-aminophenyl)diphenyl-, and *derivs.*, 2667¹.
- C₂₁H₁₁N₂O₂ Benzothiazole, 1-(*p*-benzamido-phenyl)-5-methyl-, 284^a.
- C₂₁H₁₁N₂O₂ 1,3,4-Oxadiazol-2(3)-one, 5-benzohydryl-3-phenyl-, 253^a.
- C₂₁H₁₁N₂O₂ Phthalonanilide, 265^a.
- C₂₁H₁₁N₂O₂ Benzenesulfonic acid, *m*-(1,5-diphenyl-2-imidazolyl)-, 2494².
- C₂₁H₁₁N₂O₂ Hydroquinol, 2-phenylazo-, monoacetate, monobenzoate, 44^a.
- C₂₁H₁₁N₂O₂ Hydroquinol, 2-phenylazoxy-, monoacetate, monobenzoate, 44^a.
- Mandelanilide, *m*-nitro-, benzoate, 264^a.
- C₂₁H₁₁N₂O₂S 3-(4,5-Diphenyl-2-imidazolyl)benzenediazonium sulfonate, and *salts*, 2494².
- C₂₁H₁₁N₂O₂ Ketone, carbazyl ethyl, picrate, 2492^r.
- C₂₁H₁₁N₂O₂ 1,2,3-Triazole, 1,4-diphenyl-5-*p*-toluino-, dinitro *deriv.*, 988².
- C₂₁H₁₁O Acrylophenone, β , β -diphenyl-, 984^a, 1261^r.
- Benzohydrol, α -phenylethynyl-, 984^a.
- Benzopyran, diphenyl-, 287¹.
- Carbinol, di-1-naphthyl-, 1859^a.
- Desoxybenzoic, isobenzoic, 826^a.
- C₂₁H₁₁O₂ 1(2)-Benzofuranone, 2-benzyl-2-phenyl-, 1277¹.
- 2(1)- β -Naphthofuranone, 1-allyl-1-phenyl-, 1277¹.
- C₂₁H₁₁O₂ 1,8-Indandione, 2,2'-isopropylidene-bis-, 3486^a.
- C₂₁H₁₁O₂ Anthrapurpurin, 6-methyl-, triacetate, 2491^a.
- Anthraquinone, 1,2,5-trihydroxy-8-methyl-, triacetate, 2491^a.
- Frangulaemodin, triacetate, 1860^a.
- Pyruvic acid, β , β -methylenebis[β -benzoyl-, di-Et ester, 264^a.
- C₂₁H₁₁S Anthracene, 9,10-dihydro-2-methyl-9-phenyl-9,10-thio-, 652^a.
- C₂₁H₁₁As Arsine, methyldi-1-naphthyl-, 3086^a.
- C₂₁H₁₁Br₂N Pyridine, 2-(α , β -dibromophenethyl)-, 518¹.
- C₂₁H₁₁Br₂N Pyridine, 2,6-bis(α , β -dibromophenethyl)-, 518¹.
- C₂₁H₁₁Cl Propene, chlorotriphenyl-, 826^a, 1410^a.
- C₂₁H₁₁Cl₂N Pyridine, 2-(α , β -dichlorophenethyl)-6-styryl-, 518¹.
- C₂₁H₁₁N Pyridine, 2,6-distyryl-, 518¹.
- C₂₁H₁₁NO 7-Acenaphthenone, 8-(*p*-dimethylaminobenzal)-, 821^a.
- Benzohydryl isocyanate, α -*p*-tolyl-, 642^a.
- C₂₁H₁₁NO₂ Acetanilide, 2-hydroxy-5-phenyl-, benzoate, 1858^a.
- C₂₁H₁₁NO₂ *p*-Benzotoluide, *m*-hydroxy-, *m*-hydroxybenzoate, 1417^a.
- C₂₁H₁₁N₂Na Propene, 1-(2-methyl-3-iodo-3-(2-methyl-3-pseudoindylidene)-, *N*-Na deriv., 3488^r.
- C₂₁H₁₁N₂O 9-Carbazolacetic acid, benzalhydrizide, 282^r.
- Isoxazole, 3,5-bis(2-methylindyl)-, 2493².
- C₂₁H₁₁N₂O₂ α -Toluamide, *N*-phenylimino-, oxime, Bz deriv., 3261¹.
- C₂₁H₁₁N₂O₂S Semicarbazide, dibenzoylphenylthio-, 2053².
- C₂₁H₁₁N₂ Triazole, (benzylmercapto)diphenyl-, 2053².
- C₂₁H₁₁N₂O 1,2,3-Triazole, 5-*N*-nitrosoanilino-4-phenyl-1-*p*-tolyl-, 988².
- , 5-(*N*-nitroso-*p*-toluino)-1,4-diphenyl-, 988².
- C₂₁H₁₁N₂O₂ Semicarbazone of compd. from 2-amino-1-naphthol, 2340^r.
- 1,2,3-Triazole, 5-anilino-4-phenyl-1-*p*-tolyl-, mononitro deriv., 988².
- C₂₁H₁₁N₂O₂ Indazole, benzylmethyl-, picrate, 511^r, 512^r.
- Isoindazole, benzylmethyl-, picrate, 512¹.
- C₂₁H₁₁N₂O₂S Benzothiazole, 4-methyl-1-*m*-toluino-, picrate, 1411^r.
- C₂₁H₁₁O₂ 9-Xanthyl, 3,6-dimethoxy-9-phenyl-, 2483^a.
- C₂₁H₁₁ Indan, 1,3-diphenyl-, 826^a.
- Propene, triphenyl-, 827^a, 2330^a.
- C₂₁H₁₁Br₂ Propane, 1,2-dibromo-1,1,3-triphenyl-, 2329^a.
- C₂₁H₁₁N Acridoline, 10,21-etheno-5,10,16,17-18,19-hexahydro-, 296².
- Propene, 1-(2-methyl-3-indyl)-3-(2-methyl-3-pseudoindylidene)-, perchlorate, 3488^r.
- C₂₁H₁₁N₂O 13-Acridolineacetic acid, 1,2,3,4-7,9,12-hexahydro-, inner anhydride, 296².
- 3-Chromanone, 4-phenyl-, phenylhydrazone, 286^a.
- C₂₁H₁₁N₂O₂ 13-Acridolineacetic acid, 1,2,3,4-tetrahydro-, 296².
- 1,3-Propanedione, 1,3-bis(2-methylindyl)-, 2493².
- C₂₁H₁₁N₂O₂ Benzaldehyde, *o*-(α -hydroxybenzylamino)-, oxime, Bz deriv., 510².
- , *peri*-Pyrazinocarbazol-5(6)-one, 4-(*o*-carboxyphenyl)-8,9,10,11-tetrahydro-, 294^a.
- C₂₁H₁₁N₂ 1,8-Indandione, phenylsazone, 66².
- Pyrazole, 3,5-bis(2-methylindyl)-, 2493².

- 1,3,3-Triazole, 5-anilino-4-phenyl-1-*p*-tolyl-, 988¹.
 —, 1,4-diphenyl-5-*p*-toluino-, and -*HNO*₂, 988¹.
 C₂₁H₁₈N₂O₂ α-Toluamide, *N*-phenylimino-, oxime; carbamate, 3261².
 C₂₁H₁₈O 1(8)-Anthracenone, 2-benzyl-3,4,5,6,7,8-hexahydro-, 1273⁶.
 2-Propanone, 1,1,3-triphenyl-, 636².
 1-Propenol, triphenyl-, 826², 1410⁷, 1566^{4,8}.
 C₂₁H₁₈O₂ Benzaurin, dimethyl-, *derivs.*, 271⁴.
 1-Benzofuranol, 1,2-dihydro-2-methyl-1,2-diphenyl-, 1276².
 Benzoin, benzyl-, 59¹, 2819¹.
 Chromanol, diphenyl-, 286², 287¹.
 Propiophenone, β-hydroxy-β,β-diphenyl-, 985¹.
 C₂₁H₁₈O₂ Phenol, α-β-phenylethoxy-, benzoate, 1423².
 C₂₁H₁₈O₂ 3-Xanthenyl, 5-(2,4-dihydroxybenzyl)-7-methyl-, 1568².
 Xanthidrol, 9-anisyl-3-methoxy-, 649².
 C₂₁H₁₈O₂ Δ²-1-Propenol, 1,3,3-triphenyl-, acid sulfate, 826².
 C₂₁H₁₈O₂ Phenolsulfonephthalein, di-Me ether, 490².
 C₂₁H₁₈O₂ Benzil, 2,4,6-trihydroxy-methoxy-, triacetate, 2946².
 C₂₁H₁₈O₂ Isothionaphthene, 1,2-dihydro-1-phenyl-2-*p*-tolyl-, 652².
 C₂₁H₁₈Br₂O₂ Glyoxal, 5-bromo-2-hydroxy-*p*-anisyl-, osazone, 2047⁴.
 C₂₁H₁₈BrO₂ Methane, bromo(2,5-dimethoxyphenyl)diphenyl-, 2946².
 C₂₁H₁₈ClO₂ Methane, chloro(2,4-dimethoxyphenyl)diphenyl-, 2946².
 C₂₁H₁₈IN₂ 1,2-Dibenzylindazolium iodide, 3091².
 C₂₁H₁₈NO Benzamide, *N*-(β,β-diphenylethyl)-, 2822¹.
 C₂₁H₁₈NO₂ Acetohydroxamic acid, diphenyl-*p*-tolyl-, 642².
 Benzamide, *N*-(β-hydroxy-β,β-diphenylethyl)-, 635², 3254⁴.
 Benzanilide, α-β-phenylethoxy-, 1423².
p-Cresol, 2-benzyl-, carbamate, 2038².
 Glycine, *N*-triphenylmethyl-, and salts, 2479^{2,4}.
 C₂₁H₁₈N₂O Benzamidine, amino-*N*,*N'*-diphenyl-, Ac *deriv.*, 645².
 Benzophenone, 4-*p*-tolylsemicarbazone, 478².
 C₂₁H₁₈N₂O₂ Benzoin, 4-phenylsemicarbazone, 2666².
 C₂₁H₁₈N₂O₂ 1,2-Dibenzylindazolium nitrate, 3091².
 C₂₁H₁₈O₂ Methyl, (dimethoxyphenyl)diphenyl-, 2946².
 C₂₁H₁₈ Anthracene, 5-benzyl-1,2,3,4-tetrahydro-, 1273⁶.
 Propane, 1,1,3-triphenyl-, 826².
 C₂₁H₁₈Cl₂O₂ Glucoside, α-methyl-, 5,6-dichlorohydrin, dibenzoate, 2490².
 C₂₁H₁₈N₂O Hydrazine, α-diphenylacetyl-β-tolyl-, 1254^{2,4}.
 C₂₁H₁₈N₂O₂ 3-Pyrrolidene-carboxylic acid, 5-oxano-2-keto-4-methyl-1,5-diphenyl-, Et ester, 503².
 C₂₁H₁₈N₂O₂ 9-Carbazoleacetic acid, 8-(*o*-carboxyanilino)-1,2,3,4-tetrahydro-, 294².
 Propiophenone, β-(2,4-dihydroxyphenyl)-2,4-dihydroxy-, phenylthio-, 2038².
 Quinidine, α-*p*-dimethylaminophenyl-, oxalate, 1267⁴.
 C₂₁H₁₈N₂O₂ Isoquinaldonitrile, 2-(2,3-dimethoxybenzoyl)-1,2-dihydro-6,7-dimethoxy-, 2668².
 C₂₁H₁₈N₂S Urea, α-(β,β-diphenylethyl)-β-phenylthio-, 2822².
 C₂₁H₁₈O Benzohydrol, α-(α-methylbenzyl)-, 645².
 Benzyl alcohol, α,α-dibenzyl-, 3567².
p-Cresol, 2,6-dibenzyl-, 2038².
 Ether, ethyl triphenylmethyl-, 271⁴.
 1-Propanol, triphenyl-, 827^{1,2}.
 C₂₁H₁₈O₂ Anisole, *p*,*p'*-benzalbis-, 1859¹.
 —, α,α'-tolylenebis-, 2480².
 1,2-Propanediol, triphenyl-, 1701², 2206².
 C₂₁H₁₈O₂ Cyclohexanone, 2,6-bis(*p*-hydroxybenzyl)-3-methyl-, -*HCl*, 1415².
 Δ²-Cyclohexenone, 3-(*o*-methoxystyryl)-5-salicyl-, 484².
 C₂₁H₁₈O₂ Spiro[cyclohexane-1,4'(5')-furan-2'(3'),9''-xanthen]-5'-one, 3',6''-dihydroxy-, 986².
 C₂₁H₁₈O₂ 1,10-Anthradiol, 5,6-dimethoxy-4-methyl-, diacetate, 1491².
 Chromone, 7-hydroxy-2-methyl-3-veratryl-, acetate, 2653².
 C₂₁H₁₈O₂ Benzil, 2,4-dihydroxy-3',4',5'-trimethoxy-, diacetate, 2946².
 C₂₁H₁₈AsI₂ Benzylmethyltriphenylarsonium iodide, CHI₃ addn. compd., 1403².
 C₂₁H₁₈ClN₂O₂ *p*-Toluenesulfonanilide, *N*-(β-(*o*-chloroanilino)ethyl)-, 283¹.
 C₂₁H₁₈NO Benzohydrol, α-(*o*-aminophenethyl)-, 635².
p-Phenetidine, *N*-(*η*-phenyl-Δ^{2,4,8}-heptatrienylidene)-, 2911².
 1-Propanol, 2-aminotriphenyl-, 1138².
 C₂₁H₁₈NO₂ (See also *Hydrazine*.)
 Chelidonium, methoxy-, and *aurata*, 890².
 C₂₁H₁₈O₂PS Thiophosphoric acid, tri-*p*-tolyl ester, 2325².
 C₂₁H₁₈PS₃ Tetrathiophosphoric acid, tri-*p*-tolyl ester, 2325².
 C₂₁H₁₈ Anthracene, 7(and 8)-benzyl-1,2,3,4,5,6-hexahydro-, 1273^{6,8}.
 C₂₁H₁₈Br₂ Anthracene, 2-benzyl-1,2-dibromo-3,4,5,6,7,8-hexahydro-, 1273⁶.
 C₂₁H₁₈Br₂O₂ Phlorhizin, dibromo-, 3089¹.
 C₂₁H₁₈IN₂ Tribenzylammonium triiodide, 1403².
 C₂₁H₁₈N₂ Acridoline, 10,21-ethano-5,10,15,16-17,18,19,20-octahydro-, 296².
 —, 13-ethyl-1,2,3,4,4,13-hexahydro-, 296².
 C₂₁H₁₈N₂O Ketone, δ-methylaminobutyl-2-phenyl-4-quinolyl-, and *di-HCl*, 637².
 C₂₁H₁₈N₂O₂ See *Isostrychnine*; *Strychnine*.
 C₂₁H₁₈N₂O₂S 1,2-Propanediamine, *N*¹,*N*²-diphenyl-*N*¹-phenylsulfonyl-, 492².
 C₂₁H₁₈N₂O₂ Barbituric acid, 1-benzyl-5-ethyl-5-phenethyl-, 471².
 Propene, 1-(*N*-methyl-α-ethoxyoxazolinyl)-3-(*N*-methyloxazolinylidene)-, 2054⁴.
 Strychnine, *N*-oxide, 2670².
 C₂₁H₁₈N₂O₂S 1,6-Pyridopyridine-3-carboxylic acid, 4-ethyl-1,5,6,7-tetrahydro-5,7-diketo-1,2-dimethyl-6-phenyl-7-thio-, Et ester, and salts, 2497².
 C₂₁H₁₈N₂O₂ Isoquinaldonitrile, 1,2-dihydro-6,7-dimethoxy-2-veratryl-, 2669².
 —, 2-(2,3-dimethoxybenzyl)-1,2-dihydro-6,7-dimethoxy-, 2668².
 1,6-Pyridopyridine-3-carboxylic acid, 4-ethyl-1,5,6,7-tetrahydro-5,7-diketo-1,2-dimethyl-6-phenyl-, Et ester, and *HCl*, 2497².
 C₂₁H₁₈N₂O₂S Strychnine, *N*²-sulfonated ether, 2670².

- $C_{21}H_{22}N_2O_4$ Compd., decomp. 270°, from brucinonic azide, 522³.
- $C_{21}H_{22}N_2O_7$ Heptanedioyl, bis(*p*-nitrobenzoate), 1563³, 1564¹.
- $C_{21}H_{22}N_2O_7 \Delta^2$ - Pyrazoline, 3 - (3,4-dimethoxyphenyl)-, picrolonate, 283⁴.
- $C_{21}H_{22}O_8$ Compd., m. 119-20°, from 2-methylcyclohexanone and BzH, 2933³, 2934¹.
- Pyrene deriv., m. 129.5°, 2933³.
- $C_{21}H_{22}O_8 \Delta^2$ - 1,4-Butenedione, 2-methoxy-1,4-di-2,4-xylyl-, 1268³.
- $C_{21}H_{22}O_8$ 2,9' - Spiro[1,2-pyran-xanthen]-6(5)-one, 4,4-diethyl-3,4-dihydro-3',6' - dihydroxy-, 986³.
- $C_{21}H_{22}O_7$ Chalcone, 2-hydroxy-4,3',4',5'-tetramethoxy-, acetate, 2207².
- $C_{21}H_{22}O_{11}$ Quercitrin, 93¹.
- $C_{21}H_{22}ClO_7$ 3,5,7 - Trimethoxy - 2 - (3,4,5-trimethoxyphenyl)benzopyrylium chloride, 1141⁷.
- $C_{21}H_{22}IN_2$ Quinaldine, α -(*p*-dimethylaminobenzal-), ethiodide, 1141⁷.
- $C_{21}H_{22}NO_2$ Carbanilic acid, 1,2,3,4,5,6,7,8-octahydro-1-*a*-thieryl ester, 1273⁷.
- , 1,2,3,4,5,6,7,8-octahydro - 1 - phenanthryl ester, 1274¹.
- $C_{21}H_{22}NO_4$ (See also *Cytopine*; *Heroine*.) 1,4-Benzopyra-3-carbamic acid, 4-ethoxy-8-methoxy-2-phenyl-, Et ester, 519³.
- 8 - Dibenzquinolizone, 5,6,13,13i - tetrahydro-2-hydroxy-3,10,11 - trimethoxy-13-methyl-, 2670¹.
- $C_{21}H_{22}NO_6$ Malonic acid, (α -carboxyanilinobenzyl-), di-Et ester, 1415⁹.
- $C_{21}H_{22}NO_6$ Veratric acid, 6-[(*N*-homopiperonyl-carbamyl)-methyl]-, Me ester, 2959¹.
- $C_{21}H_{22}N_2O_6$ Dinicotinic acid, 2 - cyano - 1,2-dihydro - 1,2,6 - trimethyl - 4 - (*m*-nitrophenyl)-, di-Et ester, 2497¹.
- $C_{21}H_{22}N_2O_6$ 2-Naphthylamine, 1,2,3,4-tetrahydro-7-methoxy-, picrolonate, 497³.
- $C_{21}H_{22}N_2O_6$ Picrate, m. 166°, of oxidation product from eserethole, 1140⁸.
- $C_{21}H_{22}$ Anthracene, 1 (and 2)-benzyl-1,2,3,4,5,6-, 7,8-octahydro-, 1273⁷.
- $C_{21}H_{22}ClNO_4$ 13,13i - Dihydro - 2 - hydroxy-3,10,11 - trimethoxy - 13 - methyl-dibenzquinolizinium chloride, 2669⁹.
- $C_{21}H_{22}Cl_2O_8S_2$ Glucoside, α -methyl-, 5,6-dichlorohydrin, di-*p* - toluenesulfonate, 2480².
- $C_{21}H_{22}INO_4$ 13,13i - Dihydro - 2 - hydroxy-3,10,11 - trimethoxy - 13 - methyl-dibenzquinolizinium iodide, 2669⁹.
- $C_{21}H_{22}N_2$ Acridoline, 13-ethyl-1,2,3,4,4i,7,12-, 13i-octahydro-, 296³.
- $C_{21}H_{22}N_2O$ 13 - Acridoline-ethanol, 1,2,3,4,4i,7,12,13i-octahydro-, 296².
- 3 - Pentadienone, 1,5 - bis(*p* - dimethylaminophenyl)-, 266³ and salts, 1266³.
- $C_{21}H_{22}N_2O_2$ 2 - Heptanone, 1 - piperonylidene-, phenylhydrazine, 470³.
- $C_{21}H_{22}N_2O_2$ 2,9' - Spiro[1,2-pyran-xanthen]-6(5)-one, 3',6' - bisdimethylamino-3,4-dihydro-, 986³.
- $C_{21}H_{22}N_2O_4$ Isoquinaldonitrile, 2-(2,3-dimethoxybenzyl) - 1,2,3,4 - tetrahydro - 6,7 - dimethoxy-, 2668³.
- , 1,2,3,4 - tetrahydro - 6,7 - dimethoxy - 2-veratryl-, 2669³.
- $C_{21}H_{22}N_2O_4$ 4 - Isopyrrole-methylmalonic acid, 2-[4 - (β,β - dicarboxymethyl) - 3,5-dimethyl - 2 - pyrrolylmethylene] - 3,5-dimethyl-, *deriv.*, 2823³.
- $C_{21}H_{22}N_4O_4$ Acetophenone, *x*-(cyclohexylmethyl-amino)-, picrate, 511⁴.
- $C_{21}H_{22}N_4O_4SSb$ Carbanilide, *p,p'*-diaminothioantimonyl tartarate, 1256³.
- $C_{21}H_{22}N_4O_6$ Uridine, bis(phenylhydrazino)-, 2055².
- $C_{21}H_{22}O$ 1 - Anthrol, 2 - benzyl-1,2,3,4,5,6,7,8-octahydro-, 1273³.
- $C_{21}H_{22}O_4$ 3 - Heptanone, 1 - (4 - hydroxy-*m*-anisyl)-, benzoate, 2944¹.
- 3-Hexanone, 1 - (4 - hydroxy-*m*-anisyl)-5-methyl-, benzoate, 2944¹.
- Malonic acid, diphenethyl-mono-Et ester, 81⁴.
- 3 - Pentanone, 1 - (4 - hydroxy-*m*-anisyl)-4,4-dimethyl-, benzoate, 2944².
- $C_{21}H_{22}O_6$ Malonic acid, bis(β -benzyloxyethyl)-, 2640⁷.
- $C_{21}H_{24}O_7$ Benzofuran, 1,2-dihydro-4 (and 6) (α -hydroxyveratryl)-3,5 - dimethoxy-, acetate, 484^{3,4}.
- 4 - Flavanol, 5,7,3',4'-tetramethoxy-, acetate, 483³.
- $C_{21}H_{24}O_{10} + 2H_2O$ See *Phlorhizin*.
- $C_{21}H_{22}ClO_{10}$ Salicin, tetraacetate, chloride, 308⁸.
- $C_{21}H_{22}NO_8$ Corybulbine and isocorybulbine, 2959⁴.
- 2-Dibenzoquinolizino-, 5,6,13,13i - tetrahydro - 3,10,11 - trimethoxy - 13 - methyl-, 2669⁹.
- Dinicotinic acid, 2-ethylidene-1,2-dihydro 1,6-dimethyl-4-phenyl-(?), di-Et ester, *perchlorate*, 2497¹.
- , 6 - ethyl - 1,2 - dihydro - 1 - methyl - 2-methylene - 4 - phenyl-(?), di-Et ester *perchlorate*, 2497¹.
- Malonic acid, (α -anilino-*p*-methylbenzyl)-di-Et ester, 1415⁹.
- , α -*m*-toluinobenzyl-, di-Et ester, *an* - *LiCl*, 1415⁹.
- Sapon. product, m. 205-6°, of carbethoxy corydine Me ether, 990⁴.
- $C_{21}H_{22}NO_6$ Dinicotinic acid, 4-*p*-anisyl-1,2-dihydro-1,6-dimethyl - 2 - methylene-, di-Et ester, 2497¹.
- Malonic acid, (α -anilino-*p*-methoxybenzyl)-di-Et ester, 1416¹.
- , [α -(and *p*)-methoxyanilinobenzyl]-, di-Et ester, 1416¹.
- $C_{21}H_{22}N_2NaO_4$ Propene, 3-(4-carboxy-3,5-dimethyl - 2 - isopyrrolyden)-1-(4-carboxy-3,5-dimethyl-2-pyrrolyl)-, *N,N*-deriv., 3488⁷.
- $C_{21}H_{22}N_2O$ 1(2) - Naphthalenone, 3,4-dihydro 6 (or 7)- β -phenylbutyl-, semicarbazone, 1271⁴.
- $C_{21}H_{22}NO_6$ Codcinone, hydroxy-, azine with acetone, 299⁴.
- $C_{21}H_{22}INO_6$ 2-(Carboxymethyl)isoquinolinium iodide, borpyl ester, 2028³.
- $C_{21}H_{22}INO_4$ 3,5 - Dicarboxy - 2 - ethyl-1,6-dimethyl - 4 - phenylpyridinium iodide, 2497¹.
- $C_{21}H_{22}O_2$ Acetamide, *N,N'*-methylenebis[*N*-phenethyl-, 1137³.
- Ac deriv., m. 147°, of new chelidonium alkaloid, *aurate*, 990³.
- β -Glutarotoluide, α,γ -dimethyl-, 2477³.
- $C_{21}H_{22}N_2O_3$ Coryhaphthine, 3821³.
- $C_{21}H_{22}N_2O_3$ Demethylchitamine, *and* -HCl, 2958³.
- Isoquinoline, 1,2,3,4-tetrahydro - 6,7

- dimethoxy - 1 - nitromethyl - 2 - iseratrilyl, 2669^o.
- Propene, 3 - (4 - carbethoxy - 3,5 - dimethyl - 2 - isopyrrolylidene) - F(4 - carbethoxy - 3,5 - dimethyl - 2 - pyrrolyl) -, -HCl, 3488^o.
- C₂₁H₂₅N₃O₄ 2-(Carboxymethyl)isoquinolinium nitrate, cornyl ester, 2028^o.
- Isoquinolamide, 2-(2,3-dimethoxybenzyl)-1,2,3,4 - tetrahydro - 6,7 - dimethoxy-, 2668^o.
- C₂₁H₂₅N₃O₄ Isoquinoline, 2 - (2,3 - dimethoxybenzyl) - 1,2,3,4 - tetrahydro - 6,7 - dimethoxy - 1-nitromethyl-, 2668^o.
- C₂₁H₂₅N₃O₄ d-Glucose, 3-allyl-, osazone, 2035^o.
- C₂₁H₂₅N₃O₄ Eserethol, nitroso-, picrate, 1246^o.
- C₂₁H₂₅O₄ 3-Pentanone, 1,5-bis(3,4-dimethoxyphenyl)-, 2043^o.
- C₂₁H₂₅N Piperidine, 2,6-diphenethyl-, and salts, 518^o.
- C₂₁H₂₅N₂O (See also *Laudanosine*.)
- Isoquinoline, 2-(2,3 - dimethoxybenzyl) - 1,2,3,4 - tetrahydro - 6,7 - dimethoxy - 1-methyl-, 2668^o.
- C₂₁H₂₅NO₃ Dinicotinic acid, 4-*p*-anisyl-1,2-dihydro-1,2,6-trimethyl-, di-Et ester, 2497^o.
- 3-Pentanone, 1,5 - bis(3,4 - dimethoxyphenyl)-, oxime, 2043^o.
- C₂₁H₂₅NO₃ Dinicotinic acid, 2,6-dimethyl-4-phenyl-, di-Et ester, methosulfate, 2496^o.
- C₂₁H₂₅N₂O₃ Codeinone, dihydroxyhydroxy-, azine with acetone, 290^o.
- C₂₁H₂₅N₂O₃ Isoindoloquinoxaline, 2,3-dimethoxy-methyl-, dimethosulfate, 2957^o.
- C₂₁H₂₅ClNO₂ 2-(Carboxymethyl)isoquinolinium chloride, menthyl ester, 2028^o.
- C₂₁H₂₅INO₂ 2-(Carboxymethyl)isoquinolinium iodide, menthyl ester, 2028^o.
- C₂₁H₂₅N₂ Acrindoline, 13-ethyl-1,2,3,4,4i,4z,5-, 6,7,12,12i,13i-dodecahydro-, 296^o.
- C₂₁H₂₅N₂O₂ See *Opiocene*.
- C₂₁H₂₅N₂O₂ 2-(Carboxymethyl)isoquinolinium nitrate, menthyl ester, 2028^o.
- C₂₁H₂₅N₂O₂P Lactic acid, α -phosphono-, trianiline salt, 2028^o.
- C₂₁H₂₅NQ₃ Dinicotinic acid, 4-*p*-anisyl-1,2,3,6-tetrahydro-1,2,6-trimethyl-, di-Et ester, 2497^o.
- C₂₁H₂₅BrNO₃ Acetophenone, α -(ethylmethylamino)-, *d*- α -bromocamphorsulfonate, 511^o.
- C₂₁H₂₅INO₂ Methiodide of compd. from codeinone, 297^o.
- C₂₁H₂₅INO₂ Des-N-methyl-dihydrothebaine, dihydro-, methiodide, 2827^o.
- C₂₁H₂₅N₂O Methochloride deriv., m. 123-4^o, of new chelidonium alkaloid, *aurate*, 990^o.
- C₂₁H₂₅O₃ Ketone, m. 226^o, from gitogenic acid, 3483^o.
- C₂₁H₂₅O₃ See *Lupulic acid*.
- C₂₁H₂₅O₃ Acid from gitogenic acid, 3483^o.
- C₂₁H₂₅O₃ Tribasic acid, m. 297^o, from gitogenic acid, 3483^o.
- C₂₁H₂₅N₂O₂P Lactic acid, α -phosphono-, triphenylhydrazine salt, 2028^o.
- C₂₁H₂₅N₂O₂ Aniline, N-ethyl-N-propyl-, *d*- α -bromocamphorsulfonate, 511^o.
- L₂₁O₃ Abietic acid, monohydroxy-, Me ester, 2387^o.
- Hydroxylactone, m. 106^o, from gitogenic acid, 3483^o.
- C₂₁H₂₅N₂O₃ Pentadecylaldehyde, (2,4-dinitrophenyl)ketazone, 3251^o.
- C₂₁H₂₅N₂O₃ 3 - Nonanone, 7 - diethylamino - 7 - ethyl-, picrate, 2476^o.
- C₂₁H₂₅O₃ Compd. from lupulone, 2042^o.
- C₂₁H₂₅O₃ Lupulic acid, tetrahydro-, and Cu salt, 2042^o, 2043^o.
- C₂₁H₂₅BrN₂ Pentadecylaldehyde, *p*-bromophenylhydrazine, 3251^o.
- C₂₁H₂₅CoN₂O₃ + 2H₂O, 940^o.
- C₂₁H₂₅N₂O₃ Pentadecylaldehyde, *p*-nitrophenylhydrazine, 3251^o.
- C₂₁H₂₅Br₂Cl₂Mo₂N₂O₃, 1386^o.
- C₂₁H₂₅O₃ Heptadecaerythromethylene, diacetate, 1245^o.
- C₂₁H₂₅O Heneicosanone, 1692^o, 2807^o.
- C₂₁H₂₅N₂S Pentasulfide, diallyl, tripiperidine compd., 464^o.
- C₂₁H₂₅ Heneicosane, 1692^o.
- C₂₁H₂₅N₂O Urea, eicosyl-, 759^o, 1127^o.
- C₂₁H₂₅Cl₂N₂O Phthalimide, tetrachloro-N-(9,10-dihydro - 9,10 - diketo - (1 and 2) - anthrylamino)-, 1275^o.
- C₂₁H₂₅AgBr₂Cl₂O o-Cresolphthalein, dibromotetrachloro-, di-Ag salt, 1268^o.
- C₂₁H₂₅Cl₂O Coumarin - 3,4' - 1,2, α - naphthopyrone, 6,8 - dichloro-, 824^o.
- C₂₁H₂₅Cl₂O Addn. compd., in 100-2^o, of fluorine and perchlorosindone, 1258^o.
- C₂₁H₂₅O₃ Trimethylenetriphenylmethane triketone, 1267^o.
- C₂₁H₂₅O₃ 5,7,12,14 - $\beta\beta'$ - Dibenzanthracene-tetrone, 621.
- C₂₁H₂₅O₃ $\beta\beta'$ - Dibenzanthracene-sulfonic acid, 5,7,12,14-tetrahydro - 5,7,12,14-tetraketo-, 1275^o.
- C₂₁H₂₅Br₂O Coumarin - 3,4' - naphthopyrone, 6-bromo-, 824^o.
- C₂₁H₂₅ClO₂ Coumarin - 3,4' - naphthopyrone, 6-chloro-, 824^o.
- C₂₁H₂₅NO₂ Coumarin-3,4' - 1,2- α -naphthopyrone, 6 nitro-, 824^o.
- C₂₁H₂₅Br₂Cl₂O o-Cresolphthalein, dibromotetrachloro-, 1267^o.
- C₂₁H₂₅Cl₂N₂O₃ o-Cresolphthalein, tetrachlorodinitro-, 1268^o.
- C₂₁H₂₅N₂O 1,3 - Naphthimidazole, 1,2(1',8')-naphthoylene-, 840^o.
- C₂₁H₂₅N₂O₃ Phthalimide, N-(9,10-dihydro-9,10-diketo-1 and 2)-anthrylamino-, 1275^o.
- C₂₁H₂₅O₃ Anthracene - [$\Delta^{(10)}$, 1'(α')] - thionaphthene-2',10-dione, 2338^o.
- C₂₁H₂₅O₃ Coumarin - 3,4' - naphthopyrone, 823^o, 824^o.
- 8^o *meso* - α - Naphthanthrene - 10 - carboxylic acid, 12,13-dihydro-8,13-diketo-, 1570^o.
- C₂₁H₂₅O₃ 2 - Anthraquinonecarboxylic acid, 3-benzoyl-, 63^o.
- Benzoic acid, o-(9,10-dihydro-9,10-diketo-2-anthroyl)-, 62^o.
- C₂₁H₂₅Br₂O + 2H₂O Compd., m. 140^o, from benzene and 3-bromopyromellitic anhydride, 1275^o.
- C₂₁H₂₅NO Anthracoumarin, 6-anilino-, 3269^o.
- C₂₁H₂₅Cl₂N₂O 4(or 5) - $\alpha\beta$ - Naphthotriazole, 2-(*p*-chlorophenyl)-5(or 4)-phenylazo-, 1865^o.
- C₂₁H₂₅Cl₂O o - Cresolphthalein, tetrachloro-, 1267^o.
- Iso - o - cresolphthalein, tetrachloro-, 1268^o.
- C₂₁H₂₅CuN₂O₃, 2173^o.
- C₂₁H₂₅N₂O₃ Naphthalimide, N-(2-amino-1-naphthyl)-, 830^o.
- 4,9 - $\beta\beta$ - Naphthimidazolidone, 2-methyl-1-(2-naphthyl)-. 2821^o.

- $C_{22}H_{17}N_3S$ 1,2,4-Thiadiazole, 3,5-di-1-naphthyl-, 3087¹.
 $C_{22}H_{17}N_4$ Benzofluorindine, 1283².
 $C_{22}H_{16}O_2$ 1,4-Naphthoquinone, 2,3-diphenyl-, 2660⁴.
 $C_{22}H_{16}O_2$ Isobenzofuran, 1,2-dibenzoyl-, 2660⁴.
 $C_{22}H_{16}O_2$ Benzoic acid, 2-benzoyl-4,2'-carbonyl-bis-, 62².
 $C_{22}H_{15}NO$ Ketone, 4-hydroxy-3-phenyl-1-isquinolyl phenyl-, 2660⁴.
 $C_{22}H_{15}NO$ Benzamide, N-(2-methyl-1-anthraquinonyl)-, 2950⁸.
 $C_{22}H_{15}N_2O_2$ *p*-Benzotoluide, α -(4-cyano-2-nitrobenzal)-, 1420².
 $C_{22}H_{15}N_2O_2$ 4-Naphthoquinone, 2-anilino-3-N-nitroso-anilino-, 2821⁸.
 $C_{22}H_{15}N_2O$ 4(or 5) - $\alpha\beta$ - Naphthotriazolol, 2-phenyl-5(or 4)-phenylazo-, 1865¹.
 $C_{22}H_{15}N_2O_{10}$ Oxindole, 3 - (6 - aminopiperonylidene)-, picrate, 2956⁴.
 $C_{22}H_{14}$ Naphthalene, 1,4-diphenyl-, 3268².
 $C_{22}H_{14}N_2O$ 2(1)-Naphthalenone, 4-anilino-1-phenylimino-, 2488¹.
 $C_{22}H_{14}N_2O_2$ 2-Naphthol, (o-phenoxyphenylazo)-, 1699⁸.
 $C_{22}H_{14}N_2O_2$ 1,4-Naphthoquinone, 2,3-dianilino-, 2820².
 $C_{22}H_{14}N_2O_2$ 2 - (Aminoxalinol, 3 - (2 - hydroxy-1-naphthyl)-, diacetate, 2047¹.
 $C_{22}H_{14}N_2O_2$ *p* - Toluic acid, α -*p*-benzamido-benzal, 3-nitro-, and *K* salt, 1420².
 $C_{22}H_{14}N_2O_2$ 1-Naphthoimidic acid, N-1-naphthimidothio-, 3087².
 $C_{22}H_{14}N_2O_4$ 2,7-Naphthylenediamine, dipicrate, 498¹.
 $C_{22}H_{14}O$ Naphthanthrenol, 10-methyl-, 1570⁸.
 $C_{22}H_{14}O$ 1-Naphthol, diphenyl-, 2660⁸, 3268².
 $C_{22}H_{14}O_2$ Acid, m. 168°, from 12,13-dihydro-8,13-diketo - 8 - meso- α -naphthanthrene-10-carboxylic acid, 1570⁸.
 $C_{22}H_{14}O_2$ Δ^2 -1,4-Butenedione, 2-phenoxy-1,4-diphenyl-, 1268².
 $C_{22}H_{14}O_2$ Chalcone, 4-hydroxy-, benzoate, 1414⁸.
 $C_{22}H_{14}O_2$ 1,2- α -Naphthopyrone, 4-(*p*-methoxystyryl)-, 2485⁷.
 $C_{22}H_{14}O_3$ 1,3-Thioxol-4(5)-one, 2-(3,4-methyleneedioxyphenyl)-5,5-diphenyl-, 652⁷.
 $C_{22}H_{14}O_4$ 1-Isocromancarboxylic acid, 4-hydroxy-3-keto-1,4-diphenyl-, 2660⁸.
 $C_{22}H_{14}O_4$ + H_2O Benzoic acid, *o*, *o'*, *o''*-methenyl-tris-, 1267⁷.
 $C_{22}H_{14}O_{10}$ Anthraquinone, 1,2,6,7-tetrahydroxy-, tetraacetate, 2491².
 $C_{22}H_{13}Br_2N_2O_2$ *p*-Dioxane, 2,5-dibromo-2,5-diphenyl-, picrate, 2206⁸.
 $C_{22}H_{13}ClO_4$ *o*-Xylorcinol, 2-chloro-, dibenzoate, 267⁸.
 $C_{22}H_{13}Cl_2NO$ Anthrone, 1,5-dichloro-10-(*p*-dimethylaminophenyl)-, 2490⁷.
 $C_{22}H_{13}Cl_2FeO_3$ 7 - Methoxy-2,4-diphenylbenzopyrylium ferrichloride, 2957¹.
 $C_{22}H_{13}NO_2$ *p*-Cresolisatene anhydride, 2197⁷.
 $C_{22}H_{13}NO_2$ Succinimide, N, α , β -triphenyl-, 265².
 $C_{22}H_{13}NO_2$ 1,1'-Binaphthyl, 4-ethoxy-5'-nitro-, 2948⁸.
 Δ^2 - Isogazoline, 5 - (*p* - hydroxyphenyl) - 3 - phenyl-, benzoate, 1415⁸.
 $C_{22}H_{13}NO_2$ Benzanilide, hydroxy-, acetoxybenzoate, 1417².
 $C_{22}H_{13}NO_2$ Carbanilic acid, benzoylhydroxy-, tolyl ester, benzoate, 3258⁸.
 $C_{22}H_{13}NO_2$ - Toluamylid, α - hydroxy - 3,4 - methylenedioxy-, benzoate, 264¹.
 $C_{22}H_{13}NO_2$ 1,4-Naphthoquinone, 2-(*p*-amino-anilino)-3-anilino-, 2821⁸.
 $C_{22}H_{13}NO_2$ Quinaldine, 4-anilino-, picrate, 1279⁸.
 $C_{22}H_{13}BrNO_2$ 2,5 - Benzoxylide, 3' - bromo - 3' - hydroxy-, benzoate, 2340⁸.
 $C_{22}H_{13}BrNO_2$ *o*-Cresaurin, dibromo-, 2486⁸.
 $C_{22}H_{13}N_2O$ Naphthylenediamine, N-acetyl-N-naphthyl-, 2200⁴.
 $C_{22}H_{13}N_2O$ Quinoxaline, 2-*p*-anil-3-benzyl-, 1419⁸.
 $C_{22}H_{13}N_2O_2$ 4,9- $\beta\beta$ -Naphthimidazolediol, 2-methyl-1-phenyl-, diacetate, 2821¹.
 $C_{22}H_{13}N_2O_2$ Δ^2 -Pyrroline, 2,4-diphenyl-, picrate, 2822².
 $C_{22}H_{13}O$ Benzopyran, phenyl-*p*-tolyl-, 287⁴.
 $C_{22}H_{13}O$ Ether, methyl α -phenylethynylbenzohydryl-, 985¹.
 $C_{22}H_{13}O$ 2-Propion-1-ol, 1,1,3-triphenyl-, Me ether, 1261⁸.
 $C_{22}H_{13}O$ Acetophenone, *o*-phenacyl- α -phenyl-, 2660⁸.
 $C_{22}H_{13}O$ 1(2) - Benzofuranone, 2 - benzyl - 4 - methyl-2-phenyl-, 1277¹.
 $C_{22}H_{13}O$ 1,4 - Naphthalenediol, 1,4 - dihydro - 1,4 - diphenyl-, 3268².
 $C_{22}H_{13}O$ Phthalide, 2,2 - di - *o* - tolyl-, 1267⁸.
 $C_{22}H_{13}O_2S$ 1,3-Thioxol-4(5)-one, 5,5-diphenyl-2-*p*-tolyl-, 652⁷.
 $C_{22}H_{13}O_2$ Acetic acid, (*p*-hydroxyphenyl)diphenyl-, acetate, 272².
 $C_{22}H_{13}O_2$ Phthalide, 2-*o*-anisyl-2-*p*-anisyl-, 272².
 $C_{22}H_{13}O_2$ Diacetate, m. 222°, of compd. from 2-methyl-5-benzofuranol, 2665⁸.
 $C_{22}H_{13}O_2$ Atromentin, di-Me ether, 639⁸.
 $C_{22}H_{13}O_2$ Pyruvic acid, β , β' -ethylidenebis[β -benzoyl-, di-Et ester, 265¹.
 $C_{22}H_{13}BrNO_2$ Anthraquinone, 1 - amino - 4 - hydroxy-, diboroacetate, 2202⁸.
 $C_{22}H_{13}CdN_2O_2S$ 1995⁸.
 $C_{22}H_{13}CoN_2O_2S$ 1995⁸.
 $C_{22}H_{13}CuN_2O_2S$ 1995⁸.
 $C_{22}H_{13}IN_2O$ Oxazole, (*p*-aminophenyl)diphenyl-, methiodide, 2667².
 $C_{22}H_{13}NO$ Phthalimidine, 3,3-dibenzyl-, 261⁴.
 $C_{22}H_{13}NO$ Acetonitrile, dicresylphenyl-, 2717¹.
 $C_{22}H_{13}NO$ Phenol, *o*-phenylallyl-, carbanilate, 1566⁸, 2038⁸.
 $C_{22}H_{13}NO_2$ 2,5-Benzoxylide, 6'-hydroxy-, benzoate, 2340⁸.
 $C_{22}H_{13}NO_2$ Succinamic acid, α , β -diphenyl-, 265¹.
 $C_{22}H_{13}NO_2$ Cresotic acid, phenylcarbamyltolyl ester, 518¹, 521².
 $C_{22}H_{13}N_2O_2$ Benzil, mono- α -benzylsemicarbazone, 2660².
 $C_{22}H_{13}N_2O_2$ *p*-Dioxane, 2,5-diphenyl-, picrate, 2206⁸.
 $C_{22}H_{13}BrO_4$ 3,7-Pentadienic acid, 8-phenyl-, dibromide of dimer, 2941¹.
 $C_{22}H_{13}BrO_4$ 1,4-Butanedione, 1,4-bis(bromo-2,5-cresyl)-, diacetate, 2046⁸.
 $C_{22}H_{13}BrO_4$ 2,3-dibromo-1,4-di-2,5-cresyl-, diacetate, 2046⁸.
 $C_{22}H_{13}Br_2N$ Methylamine, N-bromo-N(α , β -dibromoisopropyl)- α -triphenyl-, 245¹.
 $C_{22}H_{13}ClIN$ Dye from compd. from 4-chloro-quinaldine and MeI, 1279⁸.
 $C_{22}H_{13}ClIN$ Quinoline, 4-chloro-1,2-dihydro-1-methyl-2-(2-methyl-4-quinolylmethylene)-, methiodide, and chloroplatinate, 1279⁸.
 $C_{22}H_{13}ClNO$ 3 - Dimethoxy - 10 - benzyl-acridinium chloride, 3567².
 $C_{22}H_{13}N_2$ α , β -Pentadienaldehyde, δ - phenyl-, azine, 2041¹.

- Pseudoisindole, 3-amino-1,1-dibenzyl-, and *HCl*, 261¹.
- C₂₂H₂₀N₂O γ-Isodurylanilide, α²-phenylimino-, 283¹.
- C₂₂H₂₀N₂O₂ Acetanilide, *N*, *N'*-*o*-phenylenebis-, 294¹.
- 1,4-Benzodioxone, 1,4-bis(2-methylindyl)-, 2493¹.
- Ethylethyldiamine, *N*, *N'*-diacetyl-*N*-phenyl-, 263¹.
- Glyoxylamide, (6-hydroxy-2,4-xylyl)-*N*, *N'*-diphenyl-, 2046¹.
- Hydrazine, acetyldiphenylacetyl-α-phenyl-, 1253¹, 1254¹.
- Ketone, 2-keto-1¹-methyl-3-piperidyl-2-phenyl-4-quinolyl-, 657¹.
- Terephthalanilide, *N*, *N'*-dimethyl-, 490¹.
- C₂₂H₂₀N₂O₂S Acridine, 1-(*N*-ethyl-*p*-tolylsulfonamido)-, 295¹.
- Δ²-Pyrazoline, 3,5-diphenyl-1-*p*-tolylsulfonfyl-, 283¹.
- C₂₂H₂₀N₂ 1,2,3-Benzotriazine, 3,4-dihydro-7-methyl-3-*p*-tolyl-4-*p*-tolylimino-, 645¹.
- C₂₂H₂₀N₂O₂ α-Toluamide, *N*-*p*-tolylimino-, oxime, carbanilate, 3262¹.
- C₂₂H₂₀N₂O₂ 1,2,3-Benzotriazine, 3-*p*-anisyl-4-*p*-anisylimino-3,4-dihydro-7-methoxy-, 646¹.
- C₂₂H₂₀N₂O₂S 1,3,4-Thiadiazole, 2,2'-dithiobis[4-acetyl-4,5-dihydro-5-*p*-tolylimino-, 988¹.
- C₂₂H₂₀N₂O Ether, methyl triphenylallyl-, 826¹, 1410¹, 2320¹.
- , methyl α,γ,γ-triphenylpropenyl-, 1411¹.
- C₂₂H₂₀N₂O₂ Propiophenone, β-phenyl-β-*p*-tolylmercapto-, 1563¹.
- C₂₂H₂₀N₂O₂ Acetic acid, phenyl-*p*-tolyl-, benzyl ester, 645¹.
- Chromanol, phenyl-*p*-tolyl-, 287¹.
- Hydrocinnamic acid, α-phenyl-α-*p*-tolyl-, 645¹.
- Propiophenone, α-*p*-anisyl β-phenyl-, 1859¹.
- o-Tolyl acid, α,α-di-*o*-tolyl-, 1267¹.
- C₂₂H₂₀N₂O₂ o-Caesarin, 2486¹.
- Hydrocinnamic acid, α-(2,5-cresyl)-α-phenyl-, *K* salt, 1277¹.
- Propionic acid, β-triphenylmethoxy-, and *Na* salt, 2479¹.
- C₂₂H₂₀N₂O₂ 1,2'-Bibenzofuran-2-ol, 3,5,3',5'-tetramethyl-, acetate, 2046¹.
- α,γ-Pentadienic acid, 4-phenyl-, dimer of, 294F¹.
- C₂₂H₂₀BrO Propane, 2-bromo-1-methoxy-1,1,3-triphenyl-, 2329¹.
- C₂₂H₂₀ClN₂O₂S Acridin, 1-[*N*-(β-chloroethyl)-*p*-tolylsulfonamido]-, 295¹.
- C₂₂H₂₀N₂M Methylaniline, *N*-isopropylidene-α-triphenyl-, 245¹.
- C₂₂H₂₀N₂O Alanine, *N*-triphenylmethyl-, and *Na* salt, 2479¹.
- Benzamide, 3-(β-hydroxy-β,β-diphenylisopropyl)-, 3284¹.
- 1-Propanol, 1,3-diphenyl-, carbanilate, 58¹.
- 3-β,β-Pseudonaphthazofe, 2,3,3-trimethyl-, benzoate, 2207¹.
- C₂₂H₂₀N₂O Δ¹-Cyclohexenealdehyde, 2-hydroxy-3-methyl-, oxime, dibenzoyl deriv., 1277¹.
- C₂₂H₂₀N₂O 2-Quinolinetethanol, 7-methoxy-α-acetyl-, diacetate, 1279¹.
- C₂₂H₂₀N₂O Crotonanilide, α,β-disubstituted, 43¹.
- Styrylamine, *N*-*p*-anisyl-β-*o*-tolylazo-, 477¹.
- C₂₂H₂₀N₂O₂ Benzoin, 4-benzylsemicarbazone, 2660¹.
- Indazole, 3-benzamido-2-benzoyl-4,5,6,7-tetrahydro-7-methyl-, 1263¹.
- C₂₂H₂₀N₂O₂ Pyridine, amino(tetrahydro-1-methyl-2-pyrryl-, picrate, 69¹.
- C₂₂H₂₀CrN₂O₂ 67¹.
- C₂₂H₂₀CuO₂ 2,4-Pentanedione, 3-phenyl-, Cu salt, 1559¹.
- C₂₂H₂₀CuO₂ Acrylophenone, β-hydroxy-*p*,α-dimethoxy-, Cu salt, 2342¹.
- C₂₂H₂₀N₂O₂S Acridin, 1-[*N*-(β-hydroxyethyl)-*p*-tolylsulfonamido]-, 295¹.
- C₂₂H₂₀N₂O₂ Cinnamic acid, *p*,*p'*-azoxybis-, diethyl ester, 1072¹.
- C₂₂H₂₀N₂O₂ Anhydrocotarnine-6-nitro-4,5-dimethoxyphthalide, 2939¹.
- C₂₂H₂₀N₂O₂ 1,4-Butanedione, 1,4-bis(2-methylindyl)-, dioxime, 2493¹.
- 5-Pyrazolone, 4,4'-ethylenebis[3-methyl-1-phenyl-, 3096¹.
- C₂₂H₂₀N₂O₂ Ketone, 2-keto-1-methyl-3-piperidyl-3-pyrrolidyl, picrolonate, 657¹.
- C₂₂H₂₀N₂O Cyclohexanone, 2,3-bis(*p*-methylbenzyl)-, 2941¹.
- Ether, methyl α,γ,γ-triphenylpropyl-, 1411¹.
- Propane, 1-methoxy-1,1,3-triphenyl-, 2330¹.
- C₂₂H₂₀N₂O o-Cresol, 4,4',4''-methenyltris-, 2486¹.
- Cyclohexanone, anisal-*p*-hydroxybenzyl-3-methyl-, *HCl*, 1415¹.
- , 2,6-dianisal-, and *HCl*, 1415¹.
- Δ²-Cyclohexenone, 5-*o*-anisyl-3-(*o*-methoxystyryl)-, 484¹.
- C₂₂H₂₀N₂O Cyclohexanone, 2,6-dipiperonyl-, 2941¹.
- Spiro[cyclohexane-1,4'(3'')-1,2-pyran-2',9''-xanthen]-6'(5')-one, 3',4'-dihydro-3'',6''-dihydroxy-, 989¹.
- C₂₂H₂₀N₂O 1,4-Butanedione, 1,4-di-2,5-cresyl-, diacetate, 2046¹.
- C₂₂H₂₀N₂O Cyclohexanone, 2-benzal-6-*p*-dimethylaminobenzal-, and salts, 1266¹.
- Phenethyl alcohol, β-amino-α,α-dibenzyl-, 635¹.
- C₂₂H₂₀N₂O₂ 3-Pyrrolecarboxylic acid, 4-(hydroxydiphenylmethyl)-2,5-dimethyl-, Et ester, 502¹.
- C₂₂H₂₀N₂O₂ Compd. from 2-(2,3-cresyl)-1,3-butanedione and NH₄OH, 1423¹.
- C₂₂H₂₀N₂O₂ 1,3(2,4)-Isoquinolinedione, 2-homopiperonyl-6,7-dimethoxy-4,4-dimethyl-, 2950¹.
- C₂₂H₂₀N₂O₂ See *Narcotine*.
- C₂₂H₂₀N₂ *p*-Toluidine, *o*-amino-*N*, *N'*-di-*p*-tolyl-, 645¹.
- C₂₂H₂₀N₂O *p*-Anisidine, *N*-phenacyl, *o*-tolyl-hydrate, 477¹.
- C₂₂H₂₀N₂O₂ Anisamidine, 2-amino-*N*, *N'*-di-*p*-anisyl-, 646¹.
- Δ¹-Pyrazoline, 4-(dibenzoylcarbonyl)-5-isopropyl-3-methyl-, 2660¹.
- C₂₂H₂₀N₂O Nicotinic acid, 5-acetyl-4-furyl-1,6-dihydro-6-keto-1,2-dimethyl-, Et ester, phenylhydrazine, 2497¹.
- C₂₂H₂₀Br₂O 1,4-Butanedione, 2,3-dibromo-1,4-bis(2,4,6-trimethylphenyl)-, 1269¹.
- C₂₂H₂₀N₂O Piperazine, 1,4-dihippuryl-, 2830¹.
- C₂₂H₂₀O₂ Compd., m. 196-7°, from 2,6-dimethylcyclohexanone and BzH, 2933¹.
- Cyclopentane, 1,3-dibenzoyl-1,2,2-trimethyl-, 1703¹.
- C₂₂H₂₀O₂ Chalcone, 2-hydroxy-4,6,3',4',5'-pentamethoxy-, acetate, 2207¹.

- C₂₂H₃₁O₁₀S 2-Thionaphthenol, glucoside tetraacetate, 2961^s.
- C₂₂H₂₁NO Ketone, 3-benzimido-1,2-trimethylcyclopentyl phenyl, -HBr, 1703^s.
- C₂₂H₂₁NO₂ Isolobelanin, and salts, 2828^s. Lobelanine, and derivs., 2827^s.
- 1(2)-Naphthalenone, 3,4-dihydro-6(or 7)- δ -phenylbutyl-, oxime, acetate, 1271^s.
- C₂₂H₂₁NO₂ (See also *Colchicine*.)
- 1,4-Benzopyran-3-carbamic acid, 2-*p*-anisyl-8-ethoxy-4-methoxy-, Et ester, 5201.
- C₂₂H₃₁NO₂S Palmatine, methosulfate, 2561^s.
- C₂₂H₂₁ClNO Lobelide, chloro-, -HCl, 2828^s.
- C₂₂H₂₁N₂O Apoquinine, ethyl-, 1426^s.
- C₂₂H₂₁N₂O₂ 2(3),9' - Spiro[furan-xanthen] 5(4)-one, 3',6' - bisdimethylamino - 4,4 - dimethyl-, -HCl, 986^s.
- C₂₂H₂₁N₂O₂ Dinicotinic acid, 4-*p*-anisyl-2-cyano-1,2-dihydro - 1,2,6 - trimethyl-, di-Et ester, 2497^s.
- , 1,2 - dihydro - 1,4,6 - trimethyl - 2 - (phenylcarbamylmethylene)-, di-Et ester, and -HCl, 2497^s.
- C₂₂H₂₁N₂O₂ + 4H₂O, Compd., decomp. 156°, from echitamine and HNO₃, 2958^s.
- C₂₂H₂₁O Cyclohexanone, 2,6 - bis(*p*-methylbenzyl)-, 2941^s.
- C₂₂H₂₁O Cyclohexanone, 2,6-bis(*p*-methoxybenzyl)-, 2941^s.
- C₂₂H₂₁O₂ Malonic acid, benzylphenethyl-, di-Et ester, 61^s.
- 3-Octanone, 1-(4-hydroxy-*m*-anisyl)-, benzoate, 2944^s.
- C₂₂H₂₁O₂ Malonic acid, benzyl(β -phenoxyethyl)-, di-Et ester, 61^s.
- C₂₂H₂₁O₂ α,γ -Dentadienic acid, δ -phenyl-, hexahydride of dimer, 2941^s.
- C₂₂H₂₁Cl₂N Lobelan, dichloro-, and -HCl, 2828^s.
- C₂₂H₂₁NO₂ Nobeline, 2828^s.
- 4 - Piperidinol, 2,6 - dimethyl - 1 - phenethyl-, benzoate, P 3492^s.
- C₂₂H₂₁NO₂ Corydaline, 2669^s.
- Dinicotinic acid, 1,2-dihydro-2-isopropylidene-6^s-methyl-4-phenyl-(?), di-Et ester, perchlorate, 2497^s.
- , 1,2 - dihydro - 6 - isopropyl - 2 - methylene-4-phenyl-(?), di-Et ester, perchlorate, 2497^s.
- Guaiacol, 5 - (1,2,3,4 - tetrahydro - 6,7 - dimethoxy - 2,4 - dimethyl - 3 - isoquinolyl) - 4 - vinyl-, and -HCl, 2670^s.
- C₂₂H₂₁N₂O₂PS Thiophosphate di-*p*-phenetidine, Ph ester, 2325^s.
- C₂₂H₂₁ClNO₂ 2-Dibenzoquinolizinal, 5,6,13,13-tetrahydro - 3,10,11 - trimethoxy - 13 - methyl-, methochloride, 2669^s.
- C₂₂H₂₁INO₂ 2 - Dibenzoquinolizinal, 5,6,13,13-tetrahydro - 3,10,11 - trimethoxy - 13 - methyl-, methochloride, 2669^s.
- C₂₂H₂₁N₂O₂ Eserechol, benzoyl-, 1426^s.
- Hydrazine, α,β -dibenzoyl- α,β -diisobutyl-, 3472^s.
- C₂₂H₂₁N₂O₂S *p* - Acetotoluide, *o,o'* - dithiobis-[*N* - ethyl-, 2339^s.
- C₂₂H₂₁N₂O₂ Carbethoxy deriv., m. 142°, of new chelidonium alkaloid, chloroaurate, 990^s.
- C₂₂H₂₁N₂O₂ Echitamine, and salts, 2957^s.
- C₂₂H₂₁N₂O₂ Histidine, *N*-(*N,O*-dicarbethoxy, tyrosyl)-, Me ester, 1248^s.
- C₂₂H₂₁O₁₁ Salicin, tetraacetate, Me ether, 3088^s.
- C₂₂H₂₁N Diphenethylamine, *N*-cyclohexyl-, and -HBr, 2828^s.
- Lobelan, and -HCl, 2828^s.
- C₂₂H₂₁NO₂ Isolobelanidine, and -HCl, 2828^s.
- Lobelanidine, and salts, 2827^s.
- C₂₂H₂₁NO₂S 3,5 - Dicarbethoxy - 2 - ethyl - 7,8 - dimethyl - 4 - phenylpyridinium methosulfate, 2497^s.
- C₂₂H₂₁N₂O Galactosamine, diacetone-, picrolonate, 1500^s.
- C₂₂H₂₁BrNO₂S 2-Propanone, 1-(1,2,3,4-tetrahydro-1-quinolyl)-, *d*- α -bromocaphorsulfonate, 5114^s.
- C₂₂H₂₁INO₂ Thebeninmethine, dihydrodimethoxy-, methiodide, 2829^s.
- C₂₂H₂₁N₂O Caprylophane, *p*-methoxy-, phenylhydrazone, 2671^s.
- C₂₂H₂₁N₂O Δ^2 -1 - Propenol, 1 - (4,5 - dimethoxy-2-propylanilino) - 3 - (*p* - dimethylamino-phenyl)-, and -HCl, 2474^s.
- C₂₂H₂₁N₂O₂ Biurea, α,α' - diisobutyl - β,β' - diphenyl-, 3478^s.
- C₂₂H₂₁N₂S₂ Biurea, α,α' - di - *sec* - butyl - β,β' - diphenyldithio-, 3477^s.
- C₂₂H₂₁O₂S₂ Addn. compd. of carbonyl disulfide and dimethylketene, 2189^s.
- C₂₂H₂₁O₂S₂ Addn. compd. of dimethylketene and carbonyl sulfide, 2189^s.
- C₂₂H₂₁O₂ Addn. compd., m. 94°, of dimethyl oxalate and resorcinol, 1704^s.
- C₂₂H₂₁NO₂S Thebeninmethine, hydrodimethoxy-, methyl sulfate, 2829^s.
- C₂₂H₂₁O Ketone, m. 143-4°, from desoxybilanic acid, 2531, 1854^s.
- C₂₂H₂₁O₂ Acid, m. 238°, from gitogenic acid, 3483^s.
- C₂₂H₂₁NO Oxime, m. 98-9°, of ketone from desoxybilanic acid, 1854^s.
- C₂₂H₂₁ Compd., b.p. 209-11°, from lignite, 2736^s.
- C₂₂H₂₁N₂O Hydrazine, α - (3,7 - dimethyl- Δ^2 -octenyl)- α -phenyl-, citrate, 2029^s.
- C₂₂H₂₁O Ketone, m. 136-7°, from the hydrogenation of the ketone from desoxybilanic acid, 1854^s.
- C₂₂H₂₁O₂ Clupanodonic acid, 409^s.
- C₂₂H₂₁ Hydrocarbon, m. 96°, from the ketone from pyrodesoxybilanic acid, 1854^s.
- C₂₂H₂₁Cl₂MnN₂, 1385^s.
- C₂₂H₂₁Cl₂MnN₂, 1385^s.
- C₂₂H₂₁N₂ Camphor, 6-methyl-, azine, 269^s.
- C₂₂H₂₁O₂ Acid from algae, 2969^s.
- C₂₂H₂₁O₂ Glutaric acid, α,γ -diacetyl- β -methyl-, Et menthyl ester, 2471^s.
- C₂₂H₂₁O₂ Acid saponin from *Polygala amara*, 489^s.
- C₂₂H₂₁N₂O₂ Palmitaldehyde, *p*-nitrophenylhydrazone, 3261^s.
- C₂₂H₂₁ Hexadecane, phenyl-, 1222^s.
- C₂₂H₂₁Br₂MnN₂, Piperazine, 1,4-bis[(α - bromopropionyl)leucyl]-, 2830^s.
- C₂₂H₂₁N₂ Pentadecylaldehyde methylphenylhydrazone, 3251^s.
- C₂₂H₂₁O₂ Fenchyl alcohol, laurate, 2657^s.
- C₂₂H₂₁N₂O₂ Tetraethylammonium styphnate, 2440^s.
- C₂₂H₂₁BrIO₂ Benenic acid, bromiodo-, 2637^s.
- C₂₂H₂₁N₂O₂ Piperazine, 1,4-bis(alanylleucyl)-, 2830^s.
- C₂₂H₂₁O₂ Brassidic acid, 3251^s.
- Erucic acid, 2637^s, 3251^s, salts, 1406^s.
- C₂₂H₂₁O₂ Succinic acid, α,β -dimethoxy-, di-*sec*-octyl ester, 972^s.
- C₂₂H₂₁O₂ Behenic acid, hydroxyiodo-, 2637^s.
- C₂₂H₂₁O 7-Docosanone, 1692^s.
- C₂₂H₂₁O₂ (See also *Arachidic acid*.)
- 1-Eicosanol, acetate, 1127^s.

- C₂₂H₁₆N₂O₂ See *Veratrine*.
- C₂₂H₁₆Cl₂Co₂N₁₀O₂Sb, 67^o.
- C₂₂H₁₆Br₂O₂ 3-Isioxanthone, tetrabromo-6-hydroxy - 9 - (2 - hydroxynaphthyl)-, 1568¹.
- C₂₂H₁₆ClO₂S Anthraquinone, 1-chloro-2-[(2-keto-1(2)-thionaphthenylidene)methyl]-, 2951⁷.
- C₂₂H₁₆NO₂S Anthraquinone, 2 - [(2-keto-1(2)-thionaphthenylidene)methyl] - 5 - nitro-, 2951⁷.
- C₂₂H₁₆Br₂O₂ 9-Isobenzoxanthone, dibromo-12-(2,4-dihydroxyphenyl)-, 1568¹.
- C₂₂H₁₆N₂O₂ Anthraquinone, 2-[(3-keto-2(3)-indylidene)methyl]-5-nitro-, 2951⁷.
- C₂₂H₁₆O₂S Anthraquinone, 2-[(2-keto-1(2)-thionaphthenylidene)methyl]-, 2951⁷.
- C₂₂H₁₆NO₂ Anthraquinone, 2-[(3-keto-2(3)indylidene)methyl]-, 2951⁷.
- C₂₂H₁₆O₂ 9-Isobenzoxanthone, 12-(2,4-dihydroxyphenyl)-, 1568¹.
- 3-Isioxanthone, 6-hydroxy-9-(2-hydroxynaphthyl)-, 1567^o.
- C₂₂H₁₆O₂ Benzoic acid, o-(9,10-dihydro-9,10-diketo-6-methyl-2-anthroyl)-, 62^o.
- C₂₂H₁₆Br₂N₂O₂ Pyridine, 2-bromo-3-(p-nitrophenyl)-4,6-diphenyl-, 2207⁷.
- C₂₂H₁₆NO₂ 5,10-Dioxolindenoquinoline, 10-phenyl-, and salts, 2956².
- C₂₂H₁₆BrCl Methane, bromo(p-bromophenyl)-1-naphthylphenyl-, 2045³.
- C₂₂H₁₆N₂O₂ Cyclopropanenitrile, 2-benzoyl-1-(p-nitrophenyl)-3-phenyl-, 2207⁷.
- 2-Pyridol, 3-(p-nitrophenyl)-4,6-diphenyl-, 220⁷.
- C₂₂H₁₆N₂O₂ Phenanthrenequinone, 2-acetamido-7-salicylalaminio-, 2491⁴.
- C₂₂H₁₆O₂ α-Benzoxanthene, 12-phenyl-, 2945⁴.
- C₂₂H₁₆AsNNaO₂ + 6H₂O, 2307⁴.
- C₂₂H₁₆Br Methane, bromo-1-naphthyldiphenyl-, 2044³.
- C₂₂H₁₆BrN₂O₂ Hydrocinnamonitrile, α-bromo-α-(p-nitrophenyl)-β-phenacyl-, 2207⁷.
- C₂₂H₁₆BrO₂ 2,6-Diphenyl-4-salicylpyrylium bromide, 288⁹.
- C₂₂H₁₆BrO₂ 2,4,6-Tris(p-hydroxyphenyl)pyrylium bromide, 989⁹.
- C₂₂H₁₆Cl Methane, chloro-1-naphthyldiphenyl-, 2044³.
- C₂₂H₁₆ClO₂ 2,6-Diphenyl-4-salicylpyrylium chloride, 288⁹.
- C₂₂H₁₆ClO₂ 5,7-Dihydroxy-4-(p-hydroxystyryl)-2-phenylbenzopyrylium chloride, 1707³.
- C₂₂H₁₆KNO₂Sb + 2H₂O, 2307⁴.
- C₂₂H₁₆N 9-Fluoramine, N-1-naphthyl-, 2658⁴.
- C₂₂H₁₆NNaO₂Sb + 3H₂O, 2307⁴.
- C₂₂H₁₆NO Pyridine, 2,6-diphenyl-4-salicyl-, and -HCl, 288⁹.
- C₂₂H₁₆NO Anthranilic acid, N-1-naphthyl-N-phenyl-, 511⁷.
- Cinchophen, benzyl ester, -H₂O, 78^o.
- C₂₂H₁₆NO₂ 1,3-Indandione, 2-α-hydroxybenzyl-, carbanilate, 3486⁴.
- C₂₂H₁₆N₂O₂ 2,1,3-Benzotriazole-2-p-benzenesulfonic acid, 5-(2-hydroxy-1-naphthylazo)-6-methyl-, Na salt, 2444³.
- C₂₂H₁₆O Methyl, (3-hydroxy-2-naphthyl)-diphenyl-, 2945⁴.
- C₂₂H₁₆N Quinoxaline deriv., m. 154^o, from hydrocarbon from d-methylpimaric, 647^o.
- C₂₂H₁₆N₂O₂ 1,4-Naphthoquinone, 2-anilino-2-p-toluene, 2821⁴.
- α-Tolunitrile, α,α'-(benzaldioxy)bis-, 2485⁴.
- C₂₂H₁₆N₂O₂ Hydrocinnamonitrile, α-(p-nitrophenyl)-β-phenacyl-, 2207⁷.
- 1,4-Naphthoquinone, 2-anilino-3-p-methoxyanilino-, 2821⁴.
- 2(1)-Pyridone, 3,4-dihydro-3-(p-nitrophenyl)-4,6-diphenyl-, 2207⁷.
- C₂₂H₁₆N₂O₂ 1,2-Propanedione, 1-phenyl-, li-oxime, dibenzoate, 262⁷.
- C₂₂H₁₆N₂O₂ p-Toluic acid, α-p-benzamidoben-α-3-nitro-, Me ester, 1420³.
- C₂₂H₁₆O₂ 1,3-Indandione, 2,2-dibenzyl-, 404³.
- C₂₂H₁₆O₂ 1(2)-Benzofuranone, 4-methyl-2-phenacyl-2-phenyl-, 1277¹.
- Δ¹-1,4-Butenedione, 1,4-diphenyl-2-methyl-, 1268⁹.
- C₂₂H₁₆O₂ Chalcone, hydroxymethoxy-, benzoate, 1414³.
- C₂₂H₁₆O₂ 1-Isochromanoic acid, 4-hydroxy-3-keto-1,4-diphenyl-, Me ester, 2660³.
- C₂₂H₁₆O₂ 3,9-Xanthenediol, 9-(p-hydroxyphenyl)-, diacetate, 649³.
- C₂₂H₁₆O₂ Quercetin, tetraacetate, 3270⁴.
- C₂₂H₁₆Cl 1,3-Pentadiene, 2-chloro-1,5,5-triphenyl-, 1411¹.
- C₂₂H₁₆N Benzohydrylamine, α-1-naphthyl-, 1704³; and -HCl, 2044³.
- C₂₂H₁₆NO Δ²-Pyrroline, 1-benzoyl-2,4-diphenyl-, 2822⁴.
- C₂₂H₁₆NO₂ 1,2-α-Naphthopyrone, 4-(p-dimethylaminostyryl)-, and -HCl, 2485⁴.
- Succinimide, α,β-diphenyl-N-p-tolyl-, 265⁹.
- C₂₂H₁₆NO₂ Chalcone, benzamido-4'-methoxy-, 1266³, 1268³.
- C₂₂H₁₆NO₂ p-Benzotoluide, hydroxy-, acetoxybenzoate, 1417³.
- C₂₂H₁₆N₂Na 1,3-Pentadiene, 1-(2-methyl-3-indyl)-5-(2-methyl-3-pseudoindylidene)-, N-Na deriv., 3488⁷.
- C₂₂H₁₆N₂ Aniline, p-phenylazo-N-(α-phenyl-Δ¹,4-pentadienylidene)-, 2941¹.
- C₂₂H₁₆N₂O₂ Phenanthrenequinone, 2-amino-7-(p-dimethylaminobenzalaminio)-, 2491⁴.
- C₂₂H₁₆N₂O₂S Naphthionic acid, 3-(p-hydroxyphenyl)-p-tolylazo-, Na salt, 3267⁴.
- C₂₂H₁₆N₂O₂ Picrate, m. 115^o, of compd. from d-methylpimaric, 648⁹.
- C₂₂H₁₆N₂O₂ Quinoline, 4-anilino-1,2-dihydro-1-methyl-2-methylene-(p), picrate, 279⁹.
- C₂₂H₁₆ClNO₂ α-Tolu-m-toluide, 5'-chloro-6'-hydroxy-, p-toluic acid, 1562³.
- C₂₂H₁₆F₂ Crotononitrile, β-triphenylmethylamino-, 245³.
- 1,3-Pentadiene, 1-(2-methyl-3-indyl)-5-(2-methyl-3-pseudoindylidene)-, perchlorate, 3488⁷.
- C₂₂H₁₆N₂O₂ Quinoxaline, 2-p-anisyl-3-p-methoxybenzyl-, 1419⁴.
- C₂₂H₁₆N₂O₂ Δ¹-1,2-Diazene-1-carboxylic acid, dihydro-4,4'-keto-2,3,3-triphenyl-, Et ester, 1424³.
- 1-Quinoxalinecarboxylic acid, 1,2,3,4-tetrahydro-2-keto-3,3-diphenyl-, Et ester, 1425³.
- C₂₂H₁₆N₂O₂ Hydrocinnamamide, α-(p-nitrophenyl)-β-phenacyl-, 2207⁷.
- C₂₂H₁₆N₂O₂S 1,6-Pyridopyridine-3-carboxylic acid, 4-furyl-1,5,6,7-tetrahydro-5,7-diketo-1,2-dimethyl-6-phenyl-7-thio-, Et ester, 2477⁷.
- C₂₂H₁₆N₂O₂ 1,6-Pyridopyridine-3-carboxylic acid, 4-furyl-1,5,6,7-tetrahydro-5,7-diketo-1,2-dimethyl-6-phenyl-, Et ester, 2477⁷.

- C₂₃H₂₆N₄O 1,2,3-Triazole, 5-(*N*-acetylanilino)-4-phenyl-1-*p*-tolyl-, 988³.
 —, 5-(*N*-acetyl-*p*-toluino)-, 1,4-diphenyl-, 988³.
 C₂₃H₂₆N₄O₂ Norhydrastinine, 1-benzyl-1,2-dihydro-, picrate, 2959¹.
 C₂₃H₂₆N₄O 1,4-Benzopyran, dimethyldiphenyl-, 287⁷.
 Ether, ethyl α -phenylethylbenzohydryl, 985¹.
 2-Propin-1-ol, 1,1,3-triphenyl-, Et ether, 1261⁶.
 C₂₃H₂₆O₂ Addn. compd., m. 95°, of 1,5-diphenyl-3-pentadienone and resorcinol, 1258².
 3,4-Butanedione, 1,4-diphenyl-2-*m*-toloxy-, 1268².
 C₂₃H₂₆O₄ 1-Propanol, 1,3-diphenyl-, acid phthalate, 2331¹.
 C₂₃H₂₆O₄ Cyclopentanone, 2,5-bis(*p*-hydroxybenzyl)-, diacetate, 1415¹.
 C₂₃H₂₆O₄S 7-Methoxy-2,4-diphenylbenzopyrylium methosulfate, 2957¹.
 C₂₃H₂₆N₂ Carbocyclidine, 1,1'-dimethyl-, iodide, 1141⁴.
 C₂₃H₂₆N₂O *p*-Cresol, 2- α -phenylallyl-, carbamate, 1566³.
 C₂₃H₂₆N₂O₂S 1,3-Thioxol-4(5)-one, 2-(*p*-dimethylaminophenyl)-5,5-diphenyl-, 652⁷.
 C₂₃H₂₆N₂O₂ Acetohydroxamic acid, diphenyl-*p*-tolyl-, Ac deriv., 642¹.
 Succinililic acid, *p*-methyl- α , β -diphenyl-, 265¹.
 C₂₃H₂₆N₂O₄ Cresotic acid, *p*-tolylcarbamylytolyl ester, 51¹, 521².
 C₂₃H₂₆N₂O₂ Hydrazine, α -benzoyl- α -*N*-benzoyl-acetimido- β -methyl- β -phenyl-, 256².
 C₂₃H₂₆N₂O₂ Benzophenone, 4-(*p*-carbethoxyphenyl)semicarbazone, 1130³.
 C₂₃H₂₆N₂O₂S Benzothiazole, 1-(3,4-dimethyl-anilino)-3,5-dimethyl-, picrate, 1412¹.
 Thiazolidine, 2-phenylimino-3-(2,5-xylyl)-(?), picrate, 2481⁴.
 —, 3-phenyl-2-(2,5-xylylimino)-(?), picrate, 2481⁴.
 C₂₃H₂₆N₂O₂ 13-Acridolinacetic acid, 1,2,3,4-tetrahydro-, Et ester, 296².
 Hydrazine, α -isopropyl- β -phenyl-, di-Bz deriv., 642¹.
 C₂₃H₂₆N₂O₂ 2(1)-Benzofuranone, 1-veratryl-, phenylhydrazone, 1260⁴.
 Glycine, *N*-(*N*-triphenylmethylglycyl)-(?), and *Na* salt, 2470⁹.
 4-*peri*-Pyrazinocarbazol-5(6)-one, 4-(*o*-carboxyphenyl)-8,9,10,11-tetrahydro-, Et ester, 294⁸.
 C₂₃H₂₆N₂O₂S 1-Propanesulfonic acid, 3-(2-naphthylimino)-, 2-naphthylamine salt, 2328¹.
 C₂₃H₂₆N₂O₂ Carbazic acid, β -(α -carboxybenzohydryl)- β -phenyl-, Et ester, 1245¹.
 Homoterephthalic acid, α -phenylimino-, aniline salt, 482².
 C₂₃H₂₆N₂O₂ 9-Carbazoleacetic acid, 8-(*N*-acetyl-*o*-carboxyanilino)-1,2,3,4-tetrahydro-, 294⁹.
 C₂₃H₂₆N₂S Pyrrolidine, 2,4-diphenyl-1-phenylthiocarbonyl-, 2822⁴.
 C₂₃H₂₆O₂ 2-Chromanol, dimethyldiphenyl-, 287⁷.
 Propionic acid, α -phenyl- α ,*p*-tolyl-, benzyl ester, 645¹.
 C₂₃H₂₆O₂S *o*-Cresolsulfonephthalcin, di-Me ether, and *HCl*, 4911².
 Phenolsulfonephthalcin, di-Et ether, 4911².
 C₂₃H₂₆O₁₀ Myricetin tetramethyl ether, diacetate, 1141¹.
 C₂₃H₂₆O₁₁ Benzil, 2,4,6-trihydroxy-3',4',5'-trimethoxy-, triacetate, 2946⁷.
 C₂₃H₂₆N₂O₂ Benzamide, *N*-(β -hydroxy- γ , γ' -diphenylisobutyl)-, 3254⁶.
 Carbamic acid, diphenyl-*p*-tolylmethyl-, Et ester, 642¹.
 Glycine, *N*-triphenylmethyl-, Et ester, 2470⁹.
 C₂₃H₂₆N₂O₂ Chelidonine, *O*-acetyl-methoxy-, chloroaurate, 990⁶.
 C₂₃H₂₆N₂O₂ *as*-Triazine, 2,4-*p*-anisyl-2,3,4,5-tetrahydro-6-phenyl-2-*o*-tolyl-, 478¹.
 C₂₃H₂₆N₂O₂ Benzoin, 4- α -methylbenzylsemicarbazone, 2660².
 C₂₃H₂₆ Propane, 2,2-dibenzyl-1-phenyl-, 1138⁷.
 C₂₃H₂₆N₂O₂ Ketone, δ -(*N*-ethylbenzamidobutyl)-4-quinolyl-, 657¹.
 —, ϵ -*N*-methylbenzamidobutyl-4-quinolyl-, 656⁷.
 C₂₃H₂₆N₂O₂ Ecgonine, benzoate, *p*-nitrobenzyl ester, and *derivs.*, 2343³.
 C₂₃H₂₆N₂O₂ Benzoic acid, *o*-[β -(β -anilino- α -methylpropylamino) phenylazo]-, and *NH* salt, 2936².
 C₂₃H₂₆N₂O₂S Semicarbazide, 1-(dihydroxy-*o*-toluimethyl)-4-tolyl-(?), monotoleobenzoate, 2495².
 1,3,4-Triazole-2,2,5-triol, tetrahydro-5-*o*-toluino-1-*o*-tolyl-(?), 2-thiolbenzoate, 2495².
 C₂₃H₂₆N₂O₄ Chelidamic acid, 4-anilino-, diethyl ester, phenylhydrazone, 71⁸.
 C₂₃H₂₆N₂O₂ Diphenethylamine, *N*-methyl-, picrate, 2828⁴.
 C₂₃H₂₆N₂O₂ Antipyrine, 4-glycylamino-, picronate, 2646².
 C₂₃H₂₆N₂O 2-Butanol, 3-amino-2-benzyl-1,4-diphenyl-, 635⁹.
 C₂₃H₂₆N₂O₂ Cyclohexanone, 2-*p*-anisyl-6-*p*-dimethylaminobenzal-, and *salts*, 1266⁹.
 C₂₃H₂₆N₂O₂ Ecgonine, benzoate, benzyl ester, and *derivs.*, 2343³.
 —, benzylbenzoyl-, 1602².
 Pseudoecgonine, benzoylbenzyl-, and *salts*, 2343³.
 C₂₃H₂₆N₂O₂ Ecgonine, benzoate, *o*-hydroxybenzyl ester, 2343³.
 —, Ecgonine, salicylate, benzyl ester, 2343³.
 C₂₃H₂₆N₂O₂ Δ^2 -Pyrazoline, 1-(dibenzoylcarbonyl)-5'-isobutyl-3-methyl-, 2666⁷.
 C₂₃H₂₆N₂O₂ Brucinonic azide, dihydro-, 290³.
 C₂₃H₂₆N₂O₂ Acridoline, 12-acetyl-13-ethyl-1,2,3,4,7,12,13i-octahydro-, 296⁴.
 C₂₃H₂₆N₂O₂ Addn. compd. of *p*,*p'*-bis(dimethylamino)benzophenone and resorcinol, 1265¹.
 C₂₃H₂₆N₂O₂S 1,6-Pyridopyridine-3-carboxylic acid, 1,5,6,7-tetrahydro-4-isobutyl-5,7-diketo-1,2-diethyl-6-phenyl-7-thio-, Et ester, and *HCl*, 249⁷.
 C₂₃H₂₆N₂O₂ (See also *Brucine*.)
 Cypirine-4-carboxylic acid, 2,6,7,8-tetrahydro-1-isobutyl-6,8-diketo-2,3-dimethyl-7-phenyl-, Et ester, 2497².
 1,6-Pyridopyridine-3-carboxylic acid, 1,5,6,7-tetrahydro-4-isobutyl-5,7-diketo-2,2-dimethyl-6-phenyl-, Et ester, and *HCl*, 2497².
 C₂₃H₂₆N₂O₂ Nonanedioic, bis(*p*-nitrobenzoate), 1564².
 C₂₃H₂₆N₂O₂ Baucinonic acid, hydrazone, 522⁴.

- C₂₃H₂₅N₅O₈** Malonic acid, bis(formylmethyl)-, di-Et ester, bis(*p*-methylphenylhydrazine), 1294.
- C₂₃H₂₅O₄** Acetophenone, α -(3-benzoyl-2,2,3-trimethylacetylenyl)-, 1703.
- Diphenylpyrrole deriv., m. 148-50°, 2934.
- Ditolyl deriv., m. 146°, 2933°.
- C₂₃H₂₅O₄** 4³-1,4-Butenedione, 2-methoxy-1,4-bis(2,4,6-trimethylphenyl)-, 1268°.
- C₂₃H₂₅N₅O₄** Trihydrostrophanthidin, 1281°.
- C₂₃H₂₅N₅O₄** + 3H₂O See *Narcaine*.
- C₂₃H₂₅N₅NaO₄** 1,3-Pentadiene, 5-(4-carbethoxy-3,5-dimethyl-2-isopyrrolidene)-1-(4-carbethoxy-3,5-dimethyl-2-pyrryl)-, *N*-Na deriv., 3483°.
- C₂₃H₂₅N₅O₄** Δ^1 -*p*-Menthencarbanilic acid, 3-keto-*N*-phenylhydrazine, 2727°.
- C₂₃H₂₅N₅O₄** Benzylmethyl(*N*-methylaminoethyl)phenylammonium nitrate, 2028°, 2935°.
- C₂₃H₂₅N₅O₄** Isolobefamine, methiodide, 2828°.
- C₂₃H₂₅N₅O₄** Cyclohexanecbutyramide, 2-phenylcarbamyl-, 2770°.
- C₂₃H₂₅N₅O₄** Cyclohexanepropionamide, 2-(phenylcarbamylmethyl)-, 1269°.
- C₂₃H₂₅N₅O₄** 3-Pentadienone, 1,5-bis(*p*-dimethylaminophenyl)-, acetate, 1266°.
- 2(3,9'-Spiro[furan-xanthen]-5(4)-one-3',6'-bisdimethylamino-4-ethyl-4-methyl-, -HCl, 986°.
- 2,9'-Spiro[1,2-pyran-xanthen]-6(5)-one-3',6'-bisdimethylamino-3,4-dihydro-4,4-dimethyl-, 986°.
- C₂₃H₂₅N₅O₄** 1,3-Pentadiene, 5-(4-carbethoxy-3,5-dimethyl-2-isopyrrolidene)-1-(4-carbethoxy-3,5-dimethyl-2-pyrryl)-, -HCl, 3483°.
- C₂₃H₂₅N₅O₄** Dinicotinic acid, 4-ethyl-1,2-dihydro-1,6-dimethyl-2-(phenylcarbamylmethylene)-, di-Et ester, 2497°.
- C₂₃H₂₅N₅O₄** Brucinic acid, dihydro-, hydrazide, 296°.
- C₂₃H₂₅N₅O₄** Brucinic acid, hydrazide, hydrazone, 522°.
- C₂₃H₂₅O₄** Trihydrostrophanthidin, dihydro-, 1281°.
- C₂₃H₂₅O₄** Malonic acid, diphenethyl-, di-Et ester, 61°.
- C₂₃H₂₅O₄** Malonic acid, bis(*p*-phenoxyethyl)-, di-Et ester, 61°.
- C₂₃H₂₅N₅O** Benzanilide, *N*-(3,7-dimethyl Δ^2 -octenyl)-, 2029°.
- C₂₃H₂₅N₅O** 4-Piperidinol, 2,6-dimethyl-1-phenethyl-, mandelate, *P* 3492°.
- C₂₃H₂₅N₅O** Piperidine, 2,6-diphenethyl-, oxalate, 518°.
- C₂₃H₂₅N₅** Benzaldehyde, α -(3,7-dimethyl Δ^2 -octenyl)- α -phenylhydrazine, 2029°.
- C₂₃H₂₅N₅O** Acridoline, 12-acetyl-13-ethyl-1,2,3,4,4a,5a,6,7,12,12a,13a-dodecahydro-, 296°.
- C₂₃H₂₅N₅O₂** *p*-Glutacrolide, γ , γ -diethyl-, 2477°.
- C₂₃H₂₅N₅O₂** Dihydrostrophanthidin acid, 2672°.
- C₂₃H₂₅N₅O₂** Acid, m. 230°, from oxidation of isostrophanthidin, 1142°.
- C₂₃H₂₅N₅O₂** Dihydro acid, m. 278° (decompn.), from pyrocholoidanic acid, 1854°.
- C₂₃H₂₅N₅O** Lobelan, methiodide, 2828°.
- C₂₃H₂₅N₅O** Lobelanidine, methiodide, 2828°.
- C₂₃H₂₅O₂** Pyrodesoxybilanic anhydride, 1854°.
- C₂₃H₂₅O₂** Trihydrostrophanthidin, hexahydro-, 1281°.
- C₂₃H₂₅O₂** Isostrophanthidin, 1142°.
- C₂₃H₂₅O₂** Proostrophanthidin, 1281°.
- C₂₃H₂₅O₂** Pyrocholoidanic acid, 1854°.
- C₂₃H₂₅O₂** Strophanthidin, 2072°.
- C₂₃H₂₅N₅O** ϵ -Isostrophanthidic acid, 1142°.
- C₂₃H₂₅O** α -Isostrophanthidic acid, 1142°.
- C₂₃H₂₅O** Ketopentacarboxylic acid, m. 298°, from the anhydride acid from pyrocholoidanic acid, 1854°.
- C₂₃H₂₅O** Isostrophanthidin, oxime, 1142°.
- C₂₃H₂₅O** Trihydrostrophanthidin, octahydro-, 1281°.
- C₂₃H₂₅O** Diketetononocarboxylic acid, m. 182-3°, from hyodesoxybilanic acid, 1429°.
- C₂₃H₂₅O** Pyrodesoxybilanic acid, 1854°.
- C₂₃H₂₅N₅O** Hydrazine, α -(3,7-dimethyl Δ^2 -octenyl)- α -*p*-tolyl-, citrate, 2029°.
- C₂₃H₂₅** Dehydrocholane, 1854°.
- C₂₃H₂₅N₅S** 1,3,4-Thiodiazole, 2,3-dihydro-5-methylmercapto-3-phenyl-2-tetradecylidene, 3251°.
- C₂₃H₂₅N₅O** Glutaric acid, α , γ -diacetyl- β -methyl-, *R* menthyl ester, semicarbazone, 2471°.
- C₂₃H₂₅Co₂N₅O** + 2H₂O 940°.
- C₂₃H₂₅O₂S₂** Methanestranilonic acid, pentabutyrate, and pentasobutyrate, 465°.
- C₂₃H₂₅O** 12-Tricosanone, 1692°.
- C₂₃H₂₅** Tricosane, 1692°.
- C₂₃H₂₅Cl₂O** 5,7,12,14- $\beta\beta'$ -Dibenzanthracene-tetrone, dichlorodimethyl-, 62°.
- C₂₃H₂₅O** Binaphthofuranone, 2046°, 2047°.
- C₂₃H₂₅O** Perylenetetracarboxylic acid, *P* 78°, *P* 832°.
- C₂₃H₂₅Br₂O** Isophenolphthalein tetrabromo-, diacetate, 272°.
- C₂₃H₂₅Cl₂N₅O** Triphenazineoxazine, 3-chloro-5-phenyl-, 1283°.
- C₂₃H₂₅O** Isophenolphthalein, tetraodo-, diacetate, 272°.
- C₂₃H₂₅N₅O** α -Benzophenazine - [Δ^2 (*h*), Δ^2 (*h'*)] - thionaphthen-2'-one, and -HCl, 2337°.
- C₂₃H₂₅N₅O** 6,13-Diindolopyridinedimethyl-, 7-phenyl-, 280°.
- C₂₃H₂₅N₅O** Indophenin, 1277°.
- C₂₃H₂₅N₅O** Isoquinoline, 6,7-methylenedioxy-1-(3,4-methylenedioxybenzoyl)-, picrate, 2671°.
- C₂₃H₂₅O** 2,1'-Bi- β -naphthofuran-1(2)-one, 2047°.
- C₂₃H₂₅O** 5,7,12,14- $\beta\beta'$ -Dibenzanthracene-tetrone, 2,10-dimethyl-, 62°.
- C₂₃H₂₅O** Coumarin-3,4'-1,2- α -naphthopyrone, 7-hydroxy-, acetate, 824°.
- C₂₃H₂₅Cl₂N₅O** 1(2)-Naphthalenone - [Δ^2 (*h'*)]-pseudoindoxyl, 4-*p*-chloroanilino-, 2493°.
- C₂₃H₂₅N₅O** Compd. from 1-(3-hydroxy-4-keto-1(4)-naphthylidene-2(1)-thionaphthenone and aniline, 2493°.
- 2(1)-Thionaphthenone, 1-(4-anilino-1-keto-2(1)-naphthylidene)-, 2493°.
- C₂₃H₂₅N₅ α , γ** Tribenzophenazine, 12-amino-, 2661°.
- C₂₃H₂₅N₅O** α -Benzophenazine - [Δ^2 (*h*), Δ^2] - indolin-3'-one, 2337°.
- Triphenazineoxazine, 5-phenyl-, 1283°.
- C₂₃H₂₅N₅O** Phthalide, 2-(4,5-bisphenyl-1,2-pyrrylene)-(?), 2951°.
- C₂₃H₂₅As₂O** Arsenic oxide, *o*,*o'*-diphenyl-, 1132°.
- C₂₃H₂₅Br₂Cl₂O** + 2H₂O, 2810°.
- C₂₃H₂₅Br₂Cl₂O** Phthalide, 2,2-bis(bromo-3-methyl-*p*-anisyl)-3,4,5,6-tetrachloro-, 1263°.
- C₂₃H₂₅Cl₂O** Isophthalic acid, 4,6-bis(chlorotolyl)-, 62°.

- Terephthalic acid, 2,5 - bis(chlorotoluy)-, 62².
- $C_{12}H_9N_2O_2$ Indoline - [$\Delta^3, \alpha'(1')$] - naphthalene-1,3-dione, 4'-anilino-, 2338¹.
- 1(2)-Naphthalenone- $[\Delta^3, \alpha']$ - pseudoindoxyl, 4-amino-, 2493².
- $C_{12}H_9N_2O_{11}$ Isoquinoline, 6,7-methylenedioxy-1-piperonyl-, picrate, 2671¹.
- $C_{12}H_9N_2O_{11}$ Isoquinoline, 3,4-dihydro - 6,7-methylenedioxy - 1 - (3,4 - methylenedioxybenzoyl)-, picrate, 2671¹.
- $C_{12}H_9O_3 \Delta^1$ - 1,4 - Butenedione, 1,4 - di - 1 - naphthyl-, 1269¹.
- $C_{12}H_9O_4$ 1,4 - Naphthalenediol, dibenzoate, 2200¹.
- $C_{12}H_9NO_5$ 5-Iso - 5,10 - dioxoloindenoquinoline, 5 - methyl - 10 - phenyl-, and picrate, 2956².
- $C_{12}H_9NO_4$ Ketone, 4-hydroxy - 3 - phenyl - 1 - isoquinolyl phenyl-, acetate, 2660⁴.
- $C_{12}H_9N_3$ 5,6-Benzozquinoxaline, 7 - amino - 2,3 - diphenyl-, 2661².
- $C_{12}H_9N_2O_4$ Ketone, benzyl 2 - naphthyl-, picrate, 2820⁴.
- $C_{12}H_9N_2O_4$ Glycerol, tris (*m* - nitrobenzoate), 247¹.
- $C_{12}H_9N_2O_7$ 2,1,3-Benzotriazole, 2-(*p*-anilino-phenyl)-, picrate, 514².
- $C_{12}H_9N_2O_5$ Diphenylamine, *p* - (*o* - nitrophenyl-azo)-, picrate, 514².
- $C_{12}H_9$ Benzene, *s*-triphenyl-, 2817¹.
- $C_{12}H_8Br_2ClN_2$ 1,1' - Dichloro - 9,10 - dihydro-9,10 - anthrylene)bispypyridinium dibromide, 60².
- $C_{12}H_8Br_2N_2O_4 \Delta^1, \alpha'(1')$ Bibenzofuran - 2 - one, 4,4' - dibromo - 1' - hydroxy - 5,5' - dimethoxy-, phenylhydrazone, 2047².
- $C_{12}H_8INO_2$ 5,10-Dioxoloindenoquinoline, 10-phenyl-, methiodide, 2956².
- $C_{12}H_8N_2O_2$ 2,3 - Naphthalenediol, 1 - (α, β - bisphenyliminoethyl)-, 828².
- $C_{12}H_8N_2O_2$ Acetanilide, *N* - (3 - anilino - 1,4 - dihydro - 1,4 - diketone - 2 - naphthyl)-, 2820².
- $C_{12}H_8N_2O_2$ 2(10) - Phenazone, 7-amino - 8 - anilino - 3 - hydroxy - 10 - phenyl-, 1283⁴.
- $C_{12}H_8N_2O_2$ Comp., m. 240°, from *p*-phenyl-azophenol, 2646².
- $C_{12}H_8N_2O_{11}$ Isoquinoline, 3,4 - dihydro - 6,7 - methylenedioxy - 1 - piperonyl-, picrate, 2670².
- $C_{12}H_8O_1$ 1 - Acetonaphthone, α, α - diphenyl-, 495².
- $C_{12}H_8O_2$ 1 - Naphthol, diphenyl-, acetate, 2660², 3268².
- $C_{12}H_8O_2$ Isophenolphthalein, diacetate, 272².
- $C_{12}H_8Br$ Methane, bromo - 1 - naphthylphenyl-*p*-tolyl-, 2045¹.
- $C_{12}H_8BrO$ Methane, *p* - anisylbromo - 1 - naphthylphenyl-, 2044².
- $C_{12}H_8BrO_2$ 4 - *o* - Anisyl - 2,6 - diphenylpyrylium bromide, 288².
- $C_{12}H_8Br_2ClN_2$ 1,1' - (Chloro - 9,10 - dihydro-9,10 - anthrylene)bispypyridinium dibromide, 60².
- $C_{12}H_8Cl$ Methane, chloro-, 1 - naphthylphenyl-*p*-tolyl-, 2045¹.
- $C_{12}H_8ClO$ Methane, anisylchloro - 1 - naphthylphenyl-, 2044², 2945².
- , chloro(3-methoxy- - 2 - naphthyl)diphenyl-, 2945².
- $C_{12}H_8ClO_4$ 4 - *o* - Anisyl - 2,6 - diphenylpyrylium chloride, $FeCl_3$ compd., 288².
- $C_{12}H_8ClO_4$ 5,7-Dihydroxy - 4 - (*p* - methoxystyryl) - 2 - phenylbenzopyrylium chloride, 1707².
- $C_{12}H_8Cl_2FeO_2$ 4 - *o* - Anisyl - 2,6 - diphenylpyrylium chloride, $FeCl_3$ compd., 288².
- $C_{12}H_8N_2$ Diphenylamine, *p* - (*o* - nitrophenyl-), 255².
- $C_{12}H_8NO$ Pyridine, 4 - *o* - anisyl - 2,6 - diphenyl-, 288².
- $C_{12}H_8NO_2$ Phthalimidine, 3 - (*p* - hydroxyphenyl)-3-salicyl-, diacetate, 272².
- $C_{12}H_8Na$ Methane, (2-methyl-3-indyl)(2-methyl - 3 - pseudoindylidene)phenyl - , *N* - Na deriv., 3488².
- $C_{12}H_8NO_2$ *o* - Quinonimine, 4,5 - dianilino - *N* - phenyl-, 2330².
- $C_{12}H_8O$ Methyl, *o* - anisyl - 1 - naphthylphenyl-, 2945².
- , (3 - methoxy - 2 - naphthyl)diphenyl-, 2945².
- $C_{12}H_8O$ Methane, 1 - naphthylphenyl - *p* - tolyl-, 2045¹.
- $C_{12}H_8ON_2O_2$ Hydroxylamine, β - nitroso - β - phenyl-, Ce salts, 1233¹.
- $C_{12}H_8OCl_2CuN_2O_4$ 2173².
- $C_{12}H_8OCl_2CuN_2O_4$ 2173².
- $C_{12}H_8OGe$ Germanium tetraphenyl-, 2473², 3239².
- $C_{12}H_8NO_2$ Methane, (2 - methyl - 3 - indyl)(2-methyl - 3 - pseudoindylidene)phenyl-, perchlorate, 3488².
- $C_{12}H_8N_2O_2$ 4,4 - Naphthoquinone, 2,3 - ditolui-, 2821².
- $C_{12}H_8N_2O_2$ 1,4-Naphthoquinone; 2 - *p* - methoxyanilino - 3 - *p* - toluino-, 2821².
- $C_{12}H_8N_2O_2$ Mauveine, 2567².
- $C_{12}H_8NO_2$ 1 - Naphthaleneglyoxal, 2,7 - dihydroxy-, bisphenylhydrazone, 828².
- $C_{12}H_8NO_2$ Pseudoisatin, 6 - amino - 1 - phenyl-, phenylhydrazone, di-Ac deriv., 646².
- $C_{12}H_8NO_2$ Isoprotoberberine, 2,3 - methylenedioxytetrahydro-, picrate, 2950¹.
- $C_{12}H_8NO_2Sn$ Hydroxylamine, β - nitroso - β - phenyl-, Sn salt, 1232².
- $C_{12}H_8O$ Benzohydrol, *p*-methyl- α -1-naphthyl-, 2045¹.
- Ether, methyl α -1-naphthylbenzohydryl-, 2044².
- Methane, anisyl-1-naphthylphenyl-, 2044², 2945².
- $C_{12}H_8O_2$ Benzohydrol, *p*-methoxy- α -1-naphthyl-, 2044².
- Carbinol, *o* - anisyl - 1 - naphthylphenyl-, 2945².
- , (2 - methoxy - 1 - naphthyl)diphenyl-, 2945².
- $C_{12}H_8O_2$ Chalcone, 2 - hydroxy - 3',4' - dimethoxy-*p* benzoate, 1200².
- $C_{12}H_8O_2$ Isophenolphthalin, diacetate, 272².
- $C_{12}H_8O_2$ Malonic acid, cinnamal-, dimer of, 2941².
- $C_{12}H_8O_{10}$ Anthraquinone, 1,4,5,8 - tetrahydroxy-2,6 - dimethyl-tetraacetate 276².
- $C_{12}H_8O_{10}$ Dermocyan, tetra-Ac deriv., 2822².
- Flavone, 3,5,3',4' - tetrahydroxy - 7 - methoxy-, tetraacetate, 3270².
- $C_{12}H_8NO$ Ethanol, 2 - amino - 1 - naphthyl-1,2-diphenyl-, 405².
- $C_{12}H_8NO_2$ 2 - Naphthol, 7 - benzamido - 5,6,7,8 - tetrahydro-, benzoate, 497².
- $C_{12}H_8NO_2$ Acetophenone, 2 - hydroxy - 4,6 - dimethyl-, oxime, di-Bz deriv., 1405¹.
- $C_{12}H_8NO_2$ 2 - Naphthaleneacetic acid, α -acetyl-3 - (*N* - acetyl-anilino) - 1,4 - dihydro 1,4-diketone-, Et ester, 2821².

- C₂₁H₂₁N₃** Triindolopyridine, 5, 11, 11, 11a, 16, - 16a-hexahydro-, 65¹.
- C₂₁H₂₁N₃O** Anthracene, 1-isopropyl-4-methyl-, picrate, 276¹.
- C₂₁H₂₁N₃O₂** Agatodiindole, 5, 10, 10a, 11-tetrahydro-, 1,6-dimethyl-, picrate, 68¹.
- C₂₁H₂₁N₃O₂** 2,173¹.
- C₂₁H₂₁N₃O₂** 4 - (N - Methylamino) - 1,2 - dimethylquinoliniumiodide, picrate, 1279¹.
- C₂₁H₂₁N₃O₂** Naphthylenediamine, N, N' - dibenzoyl - 1,2,3,4 - tetrahydro-, 498¹.
- C₂₁H₂₁N₃O₂P₂S₂** Disulfidodiphosphate dianilide, di-Ph ester, 2325¹.
- C₂₁H₂₁N₃O₂** Compd., m. 217°, from 3-acetamido - 2 - methylcinchoninic acid and HCl, 2589¹.
- C₂₁H₂₁O** Ether, α - phenylethynylbenzohydryl propyl, 985¹.
- 1,3-Pentadiene, 5-methoxy-1,1,5-triphenyl-, 1411¹.
- 2-Propin - 1-ol, 1,1,3 - triphenyl-, Pr ether, 1261¹.
- C₂₁H₂₁O₂** 1,3-Thiocol - 4(5) - one, 2-p-cumenyl-5,5-diphenyl-, 652¹.
- C₂₁H₂₁O₂** Ether, bis[β-(1-and 2)-naphthoxyethyl], 1413¹.
- 1,5 - Pentaedione, 3 - o - anisyl - 1,5 - diphenyl-, 288¹.
- C₂₁H₂₁O₂** Cyclohexanone, 2,6 - bis(p - hydroxybenzal)-, diacetate, 1415¹.
- Propiophenone, 3,4 - dimethoxy-β - salicyl-, benzoate, 1260¹.
- C₂₁H₂₁O₂** 1,1'-Bi-2-benzofuranol, 3,5,3',5'-tetramethyl-, diacetate, 2646¹.
- Pseudomeconin-, 2,2-di-4,3-cresyl-, 652¹.
- C₂₁H₂₁O₂** 1,1'-Bithioindoxyl, 6,6'-diethoxy-, diacetate, 504¹.
- C₂₁H₂₁BrN₃O** Codeinone, dibromohydroxy-, phenylhydrazone, 298¹.
- C₂₁H₂₁LiN₃O** Oxazole, (p-dimethylaminophenyl)-diphenyl-(?), methiodide, 2667¹.
- C₂₁H₂₁NO** Δ²-2-Pentefone, 4-triphenylmethyl-amino-, 245¹.
- C₂₁H₂₁NO₂** Propiophenone, 3,4-dimethoxy-β-salicyl-, benzoate, oxime, 1260¹.
- C₂₁H₂₁NO₂** 1,2,3-Propanetriamine, N¹, N², N³-tribenzoyl-, 1827¹.
- C₂₁H₂₁NO₂** Thiazolidine, 2-(o-tolylimino)-3-(2,5-xylyl)-, picrate, 2481¹.
- , 3-o-tolyl-2-(2,5-xylylimino)-, picrate, 2481¹.
- C₂₁H₂₁BrN₃O** Codeinone, bromohydroxy-, phenylhydrazone, 298¹.
- C₂₁H₂₁CdN₃O₂** Compd. from Cd(NO₃)₂ and benzidine, 2944¹.
- C₂₁H₂₁ClIN₃** Iodide of dye from N-ethylacetanilide and POCl₃, 1279¹.
- C₂₁H₂₁ClN₃** Dye from N-ethylacetanilide and POCl₃, 1279¹.
- C₂₁H₂₁CuN₃O₂**, 2173¹.
- C₂₁H₂₁N₃O₂** Phthalide, 2,2 - bis[β - (dimethyl-amino)phenyl]-, 2710¹.
- C₂₁H₂₁N₃O₂** Cyclohexanone, 2,6 - bis[α-(and p)-acetamidobenzal]-, 2263¹, 1267¹.
- C₂₁H₂₁N₃O₂** 2-Butanesulfonic acid, 4-(2-naphthylmethyl)-, 2-naphthylamine salt, 2328¹.
- , Tolidine, naphthalenesulfonate, basic salt, 680¹.
- C₂₁H₂₁N₃O₂** Benzidine, benzenesulfonate, 651¹.
- C₂₁H₂₁N₃O₂** Cyclohexanone, 2,6 - bis[α-(and p)-acetamidobenzal]-, 2263¹, 1267¹.
- C₂₁H₂₁N₃O₂** Nicotinic acid, 5-acetyl-1,6-dihydro-6 - keto - 1,2 - dimethyl - 4 - (m - nitrophenyl)-, Et ester, phenylhydrazone, 2497¹.
- C₂₁H₂₁N₃O₂** Picrate, decampa, 210°, of base from bromocodgonine, 2826¹.
- C₂₁H₂₁N₃O₂** Dimicotic acid, 4-furyl-1,2-dihydro-1,6-dimethyl-2-methylene-, di-Et ester, picrate, 2497¹.
- C₂₁H₂₁N₃O₂** 1,3,4-Thiadiazole, 2,2'-dithiobis[4 - acetyl - 4,5 - dihydro - 5 - xylimino-, 988¹.
- C₂₁H₂₁N₃O₂Zn** + H₂O Compd. from Zn(NO₃)₂ and benzidine, 2944¹.
- C₂₁H₂₁O₂** Δ³ - 2 - Hexadienone, β-phenyl-, dimer of, 2941¹.
- C₂₁H₂₁O₂** Propionic acid, β-triphenylmethoxy-, Et ester, 2479¹.
- Thebenone, monobenzal-, 2827¹.
- C₂₁H₂₁O₂** Cyclohexanone, anisal-p-hydroxybenzal-3-methyl-, acetate, 1415¹.
- Δ¹ - Cyclohexenone, 6-acetyl-5-o-anisyl-3-(o-methoxystyryl)-, 485¹.
- C₂₁H₂₁O₂** Δ³-Cyclohexenecarboxylic acid, 6-o-anisyl-4-(o - hydroxystyryl) - 2 - keto-, Et ester, 484¹.
- C₂₁H₂₁ClN₃** + H₂O Compd. from 2-(8-amino-phenyl)-4,5-diphenylimidazole, m. 249°, 2494¹.
- C₂₁H₂₁LiN₃** + 3H₂O Compd. from 2-(8-amino-phenyl)-4,5 - diphenylimidazole and MeI and MeOH, m. 150-60°, 2494¹.
- C₂₁H₂₁KN₃O₂** Potassium deriv., m. 80-90°, of 1,2'-spiro[cyclopentane - pseudoinodoxyl], 1140¹.
- C₂₁H₂₁LiN₃O₂** Lithium deriv., m. 170°, of 1,2'-spiro[cyclopentane - pseudoinodoxyl], 1140¹.
- C₂₁H₂₁NO₂** Alanine, N-triphenylmethyl-, Et ester, 2479¹.
- Benzamide, N-(β-hydroxy-α-methyl-γ,γ'-diphenylisobutyl)-, 3254¹.
- C₂₁H₂₁NO₂** Malonic acid, [α 1 (and 2)-naphthylaminobenzyl]-, di-Et ester, 1415¹.
- C₂₁H₂₁NO₂** Apoptropine, N-oxide, salicylate, 2670¹.
- C₂₁H₂₁NO₂** Compd., pt. 107°, from O-acetyl-methoxycyclidone and ClCO₂Et, 990¹.
- C₂₁H₂₁N₃NaO₂** Sodium deriv., m. 204°, of 1,2'-spiro[cyclopentane-pseudoinodoxyl], 1140¹.
- C₂₁H₂₁N₃O** as Triazine, 4-p-anisyl-2,3,4,5-tetrahydro - 3 - methyl - 6 - phenyl - 2 - o-tolyl-, 478¹.
- C₂₁H₂₁CuN₃O₂** 2,4-Pentanedione, 3-p-tolylazo-, Cu salt, 3091¹.
- C₂₁H₂₁CuO₂** 2,4-Hexanedione, 3-phenyl-, Cu deriv., 1558¹.
- 2,4-Pentanedione, 3-benzyl-, Cu deriv., 2027¹.
- C₂₁H₂₁N₃O₂** Acridan, 1 - {N - (formylmethyl)-p - tolylsulfonamidol}-, di-Me acetal, 2959¹.
- C₂₁H₂₁N₃O₂** 2,5-Piperazinedione, 3,6-bis(3,4,5-trimethoxybenzal)-, 2652¹.
- C₂₁H₂₁N₃O₂** 4,5' - Pyrrole - 3 - carboxylic acid, 4' - hydroxy - 2,2' - dimethyl - 5 - phenylazo-, di-Et ester, acetate, 75¹.
- C₂₁H₂₁N₃O₂** Tricarballic acid, trihydroxy-, trisphenylhydrazide (?), 2009¹.
- C₂₁H₂₁O** Cyclohexanone, 2,6-bis(2,4-dimethylbenzal)-, 2941¹.
- C₂₁H₂₁O₂** 3,6 - Benzofurandiol, 1,3-dihydro-4-(m-hydroxyvinyl) - 5 - methoxy-, triacetate, 484¹.
- C₂₁H₂₁NO₂** Ecgonine, benzoate, α-methylbenzyl and phenethyl esters, and salts, 2343¹.

- Pseudoecgonine, benzoylphenethyl-, and -HCl, 2343^a.
- C₁₇H₁₇N₃O₂ Ecgonine, cresotate, benzyl ester, 2343^a.
- C₁₇H₁₇N₃O₂ Corydine, carbethoxy-, Me ether, 990^a.
- C₁₇H₁₇N₃O₂ Compd. from 3-(*p*-tolylazo)-2,4-pentanedione and NH₄OH, m. 62°, 3090^a.
- C₁₇H₁₇N₃O₂ Citric acid, phenylhydrazide anilide, PhNHNH₂ salt, 1267^a.
- C₁₇H₁₇BrClN₂O₂S Brucine, bromochloromethanesulfonate, 2927^a.
- C₁₇H₁₇Cl₂MnN₂, 1385^a.
- C₁₇H₁₇N₂O Cyclohexanone, 2,6-bis(*p*-dimethylaminobenzal)-, and salts, 1267^a.
- C₁₇H₁₇N₂O Addn. compd., m. 122-3°, of 1,4-dimethyl-2,5-piperazinedione and skatole, 2033^a.
- C₁₇H₁₇N₂O Piperazine, 1,4-dialanyl-, di-Bz deriv., 2830^a.
- C₁₇H₁₇N₂O Compd. from Ni(NO₃)₂ and benzidine, 2944^a.
- C₁₇H₁₇O₂ Diphenylpyrone deriv., m. 136-7°, 2934^a.
- C₁₇H₁₇N₂O Quinine-amine, diacetyl deriv., 2055^a.
- C₁₇H₁₇N₂O 3,3'-Biindazole, 4,5,6,7,4',5',6',7'-octahydro - 7,7',2',2'-tetramethyl-, picrate, 1263^a.
- C₁₇H₁₇Br₂O₁₁ Salicin, tetraacetate, allyl ether, ditromide, 3088^a.
- C₁₇H₁₇N₂ Addn. compd. of *p*-phenylenediamine and 1,1'-dimethyl-4,4'-bipyridinium diiodide, 2053^a.
- C₁₇H₁₇N₂O₂ 2(3,9') - Spiro[furan - xanthen]-5(4) - one, 3',6' - bisdimethylamino-4,4-diethyl-, -HCl, 986^a.
- 2,9' - Spiro[1,2 - pyran - xanthen] - 6(5)-one, 3',6' - bisdimethylamino-4-ethyl-3,4-dihydro-4-methyl-, 986^a.
- C₁₇H₁₇N₂O₂ Pyrrole, 2,2' - [5 - (ethoxymethyl)-2-furylmethylene]bis[4 - acetyl - 3,5-dimethyl-], 75^a.
- C₁₇H₁₇N₂O₂ EcBtamine, hydrogen oxalate, 2958^a.
- 2,5 - Piperazinedione, 3,6-bis(3,4,5-trimethoxybenzyl)-, 2652^a.
- C₁₇H₁₇N₂O₁₁ Dinicotinic acid, 1,2-dihydro - 4 - isobutyl - 1,6 - dimethyl - 2 - methylene-, di-Et ester, picrate, 2497^a.
- C₁₇H₁₇O Cyclohexanone, 2,6-bis(2,4-dimethylbenzyl)-, 2941^a.
- C₁₇H₁₇O₂ 4,4' - Bi - *o* - cresol, 6,6' - dipropyl-, diacetate, 271^a.
- C₁₇H₁₇O₁₁ Salicin, tetraacetate, allyl ether, 3088^a.
- C₁₇H₁₇N₂ Curcumone, azine, 277^a.
- C₁₇H₁₇O Me ester of acid formed by oxidation of isotrophanthidin, 1142^a.
- C₁₇H₁₇O₂ 2-Propanone, 1,3-dihydroxy-, Et cycloacetal, di-*p*-toluenesulfonate, 247^a.
- C₁₇H₁₇O₁₁ Salicin, tetraacetate, glyceryl ether, 3088^a.
- C₁₇H₁₇O₁₁ Dihexosan, hexaacetyl-, 304^a.
- C₁₇H₁₇O₂ Anacardol picrate, 8007^a.
- C₁₇H₁₇N₂O₁₁ Semicarbazone, m. 247°, of the anhydride acid from pyrocholoidamic acid, 1854^a.
- C₁₇H₁₇N₂S₂ Formamidine, C₆'-ethylenedithiobis[N - butyl - N^o-phenyl-, 3481^a.
- C₁₇H₁₇O₂ Hyodesoxybiliaric acid, lactone, 4429^a.
- C₁₇H₁₇O₂ α-Isoctrophanthidic acid, Me ester, 1142^a.
- C₁₇H₁₇N₂O₂ α-Isoctrophanthidic acid, Me ester, oxime, 1142^a.
- C₁₇H₁₇N₂O₂ Bis(diacetonegalactos)amine, bisphenylhydrazone, 1560^a.
- C₁₇H₁₇O Me ester, m. 105°, of, diacetomonocarboxylic acid from hyodesoxybiliaric acid, 1429^a.
- C₁₇H₁₇O₂ Choladienic acid, 641^a.
- Lactone, m. 215-7°, from desoxycholic acid, 1854^a.
- C₁₇H₁₇O₂ Dehydrodesoxycholic acid, 640^a.
- C₁₇H₁₇O₂ Mono-Et ester, m. 175°, of acid from gitogenic acid, 3483^a.
- C₁₇H₁₇O₂ Desoxybiliaric acid, 253^a, 641^a, 1854^a.
- Hyodesoxybiliaric acid, 1429^a.
- C₁₇H₁₇O₂ See Glycyrrhizin.
- C₁₇H₁₇Cl₂N₂O₂Pt Isopilocarpine, methylchloroplatinate, 1281^a.
- Pilocarpine, methylchloroplatinate, 1281^a.
- C₁₇H₁₇N₂O₁₁ Bis(diacetonegalactos)amine, nitroso-, 1560^a.
- C₁₇H₁₇O₂ Lactone, m. 230-2°, from hydrogenation of lactone from desoxycholic acid, 1854^a.
- C₁₇H₁₇ClO₂ Hyocholanic acid, 4-chloro-, 2818^a.
- C₁₇H₁₇N₂O₁₁ Bis(diacetonegalactos)amine, 1560^a.
- Mannose, diacetone-, secondary amine, 1561^a.
- C₁₇H₁₇Cl₂MnN₂, 1385^a.
- C₁₇H₁₇O₂ Cholanic acid, Na salt, 1854^a.
- C₁₇H₁₇O₂ Hyocholanic acid, 4-hydroxy-, 2818^a.
- C₁₇H₁₇O₂ See Desoxycholic acid.
- C₁₇H₁₇O₂ See Cholic acid.
- C₁₇H₁₇O₂ Tetraglucosan, 2027^a.
- C₁₇H₁₇N₂O₂ Stearaldehyde, *p*-nitrophenylhydrazine, 3261^a.
- C₁₇H₁₇O₁₁ + 3H₂O Cicerose, 2642^a.
- C₁₇H₁₇HgO₂ Chaulmoogric acid, ethoxy(hydroxymercuri)-, Et ester, acetate, 971^a.
- C₁₇H₁₇O₂ Fenchyl alcohol, myristate, 2657^a.
- C₁₇H₁₇O₂ Fatty acid, m. 4°, from a cerebroside from the brain, 2635^a.
- C₁₇H₁₇O₂ Lauric anhydride, 3081^a.
- C₁₇H₁₇O 7-Tetracosanone, 1692^a.
- C₁₇H₁₇O₂ Lignoceric acid, 969^a.
- C₁₇H₁₇O₁₁S₂ Methanestannonic acid, hexapropionate, 465^a.
- C₁₇H₁₇O Tetracosane, 1692^a.
- C₁₇H₁₇Cl₂MnN₂, 1385^a.
- C₁₇H₁₇O₂ 3,4'-Bicoumarin, 7'-hydroxy-, benzoate, 824^a.
- C₁₇H₁₇N₂O₂S Dye from 1 - (3 - hydroxy - 4 - keto-1(4) - naphthyliden) - 2(2' - thionaphthene and anthranilic acid, 2493^a.
- C₁₇H₁₇N₂O₂ Quinoxaline, 2-(2-hydroxy-1-naphthyl)-, benzoate, 2047^a.
- C₁₇H₁₇N₂O₂ Naphthalimide, N-(*o*-benzamidophenyl)-, 830^a.
- C₁₇H₁₇N₂O₁₁ 2,3,10,11 - Bismethylenedioxydibenazonolizinium-picrate, 2671^a.
- C₁₇H₁₇O₂ 1,2-Benzanthrenol, benzoate, 2335^a.
- C₁₇H₁₇O₂ Δ^{2,11} - Biindan - 3,3' - tione, 2'-benzyl-, 494^a.
- C₁₇H₁₇O₂ Fulgide, 27 - (3,4 - methylenedioxyphenyl) - 8,8 - diphenyl-, 3089^a.
- C₁₇H₁₇N₂O₂ 3(5) - Acridone, 7 - hydroxy - 5,5 - diphenyl-, 1280^a.
- C₁₇H₁₇ClN₂O₂ Triphenazine - 7 - oxazomum perchlorate, 5 - phenyl - 7 - methyl-, 1283^a.
- C₁₇H₁₇N₂O 3(5) - Acridone, 7 - amino - 5,5 - diphenyl-, 1280^a.
- C₁₇H₁₇N₂O₂ Emodic acid, dipyridine salt, 1860^a.
- C₁₇H₁₇N₂ Pyrazole, 3,5-diindyl-1-phenyl-, 2493^a.

C₂₅H₂₅N₂O₅ 5-Oxazolidone, β -amino-2'-cyano-amino-(7), tri-Bz deriv., 2052².

C₂₅H₂₅N₂O₅ Stilbazole, β -phenyl-, picrate, 2498².

C₂₅H₂₅N₂O₅ Dibenzocinnoline, 5,6-dihydro-2,3,10-trimethyl-4-bis(methylenedioxy)-, picrate, 2671².

C₂₅H₂₅N₂O₅ Isoquinoline, 6,7-dimethoxy-1-(3,4-methylenedioxybenzoyl)-, picrate, 520².

C₂₅H₂₅N₂O₅ 6,7-methylenedioxy-1-veratroyl-, picrate, 520².

C₂₅H₂₅N₂O₅ Addn. compd. of benzohydrol and picric acid, 1703².

C₂₅H₂₅N₂O₅ Carbanilide, 4,4'-dianilino-3,5,3',5'-tetranitro-, 2824².

C₂₅H₂₅N₂O₅ 2(1)- β -Naphthofuranone, 1-benzyl-1-phenyl-, 1277².

C₂₅H₂₅N₂O₅ Naphthalic acid, 4-(α -hydroxybenzohydryl)-, 652².

C₂₅H₂₅N₂O₅ Thiazole, 5,5'- β -chlorobenzal-bis[2-amino-4-phenyl-, 513².

C₂₅H₂₅N₂O₅ 2-(Hydroxystyryl)-4,6-diphenylpyrylium chloride, FeCl₃ compd., 519².

C₂₅H₂₅N₂O₅ 7-Hydroxy-2,4-bis(β -hydroxystyryl)benzopyrylium chloride, 1707².

C₂₅H₂₅N₂O₅ Diphenylstyrylpyrylium perchlorate, 519².

C₂₅H₂₅N₂O₅ (Hydroxystyryl)diphenylpyrylium perchlorate, 519².

C₂₅H₂₅N₂O₅ 2,6-Diphenyl-4-salicylpyrylium perchlorate, acetate, 288².

C₂₅H₂₅N₂O₅ Carbazine, 7-amino-5,5-diphenyl-, HCl, 1280².

C₂₅H₂₅N₂O₅ 3(5)-Azirione, 7,9-diamino-5,5-diphenyl-, 128².

C₂₅H₂₅N₂O₅ 4-Imidazolol-3-benzoyl-2-benzoylimino-2,3-dihydro-1-methyl-, benzoate, 1853².

C₂₅H₂₅N₂O₅ Thiazole, 5,5'-nitrobenzalb[2-amino-4-phenyl-, 513².

C₂₅H₂₅N₂O₅ Acenaphthenes-3-benzohydryl-, 652². Chrysanthrene, 11-(2,5-xylyl)-, 2045².

C₂₅H₂₅N₂O₅ Toluene, diphenyl- β -phenyl-, 2041².

C₂₅H₂₅N₂O₅ 5-Iso-5,10-dioxolindenoquinoline, 5-methyl-10-phenyl-, methiodide, 164².

C₂₅H₂₅N₂O₅ Urea, tetraphenyl-, 754².

C₂₅H₂₅N₂O₅ Cyclopentenedione, (dimethylamino)phenylimino)diphenyl-, 1647².

Δ^2 -Cyclopentenone, 2,5-bis- β -dimethylaminophenylimino-3,4-diphenyl-, 1647².

Hydroxylamine, β -nitroso- β -(α -triphenyl- β -tolyl)-, 2037².

C₂₅H₂₅N₂O₅ 5-Oxazolidinecarbinol, 3-benzoyl-2-(benzoylimino)-, benzoate, 2052².

C₂₅H₂₅N₂O₅ Benzyl alcohol, α,α' -bis(2-amino-4-phenyl-5-thieryl)-, 512².

Thiazole, 5,5'- β -hydroxybenzalbis[2-amino-4-phenyl-, 513².

—, 5,5'-salicylalbis[2-amino-4-phenyl-, 513².

C₂₅H₂₅N₂O₅ Isoquinoline, 3,4-dihydro-6,7-dimethoxy-1-(3,4-methylenedioxybenzoyl)-, picrate, 520².

C₂₅H₂₅N₂O₅ Thiazole, 5,5'-benzalbis[2-amino-4-phenyl-, 512².

C₂₅H₂₅N₂O₅ Benzamide, α -amino- N,N' -diphenyl-, picrate, 64².

C₂₅H₂₅N₂O₅ Acetic acid, α -1-naphthylbenzohydryl ester, 1704².

C₂₅H₂₅N₂O₅ Acetyl deriv. from the acetate of 2,6-diphenyl-4-salicylpyrylium perchlorate, 112-3², 288².

C₂₅H₂₅OdN₂O₅, 1995².

C₂₅H₂₅Cl Methane, chloro-1-naphthylphenyl-xylyl-, 2045².

—, chloro-1-naphthyl- β -tolyl-, 2045².

C₂₅H₂₅ClO₄ 4-[o(and β)-Hydroxystyryl]-5,7-dimethoxy-2-phenylbenzopyrylium chloride, 1707².

C₂₅H₂₅ClO₄ Phenol, β,β',β'' -(chloromethenyl)-bis-, triacetate, 642².

C₂₅H₂₅CoN₂O₅, 1995².

C₂₅H₂₅CuN₂O₅, 1995².

C₂₅H₂₅NO Hydroxylamine, β -(α -triphenyl- β -tolyl)-, 2037².

C₂₅H₂₅NO₅ 5,10-Dioxolindenoquinoline, 10-phenyl-, methosulfate, 2956².

C₂₅H₂₅N₂ Aniline, β -phenylazo- N -(η -phenyl- $\Delta^{3,4,5}$ -heptatrienylidene)-, 2941².

C₂₅H₂₅N₂O₅ 1,6-Pyridopyridine-3-carboxylic acid, 1,5,6,7-tetrahydro-5,7-diketo-1,2-dimethyl-4-(m -nitrophenyl) 6-phenyl-7-thio-, Et ester, 2497².

C₂₅H₂₅N₂O₅ 1,6-Pyridopyridine-3-carboxylic acid, 1,5,6,7-tetrahydro-5,7-diketo-1,2-dimethyl-4-(m -nitrophenyl) 6-phenyl-, Et ester, 2497².

C₂₅H₂₅As Benzyltriphenylarsonium iodide, 1403².

C₂₅H₂₅As Benzyltriphenylarsonium triiodide, 1403².

C₂₅H₂₅Br₂O 7-Tridecatetrenone, β -tetrabromo-1,13-diphenyl-, 2940².

C₂₅H₂₅Br₂O 7-Tridecanone, dodecubromo-1,13-diphenyl-, 2940².

C₂₅H₂₅ClNO₄ 4-(β -Dimethylaminostyryl)-5,7-dihydroxy-2-phenylbenzopyrylium chloride, and salt, 1707².

C₂₅H₂₅Hg₂N₂O Carbazide, mercuridiphenylmercuridiphenyl-, 256².

C₂₅H₂₅N₂O₅ 1-Quinoxalinecarboxylic acid, 4-acetyl-1,2,3,4-tetrahydro-2-keto-3,3-diphenyl-, Et ester, 1425².

β -Truxinanilic acid, N -nitroso-, Me ester, 2825².

C₂₅H₂₅N₂S Carbanilide, β,β',β'' -bis(β -amino phenyl)thio-, 2657².

C₂₅H₂₅O Ether, ethyl α -1-naphthylbenzohydryl-, 2044².

—, methyl β -methyl- α -1-naphthylbenzohydryl-, 2045².

$\Delta^{1,2,3,4,5,10,11}$ -7-Tridecahexenone, 1,13-diphenyl-, and HCl, 2940².

C₂₅H₂₅O₂ Spiro[cyclohexane-1,1'-cyclopropane-2',1''-cyclohexane]-2,6,2'',6''-tetrone, 4,4''-diphenyl-, 1263².

C₂₅H₂₅O₂ Benzoic acid, α,α',α'' -methenyltris-tri-Me ester, 1267².

C₂₅H₂₅BrN₂O Isoquinoline, 1-(6-bromoveratryl)-1,2,3,4-tetrahydro-6,7-methylenedioxy-, picrate, 2669².

C₂₅H₂₅NO₅ β -Truxinanilic acid, Me ester, 2825².

C₂₅H₂₅NO₅ Pseudopelletierine, 2,4-dipiperonylidene, 522².

C₂₅H₂₅O₂ Addn. compd. of benzohydrol with PhOH, 1703².

C₂₅H₂₅O₂ 1,3-Cyclohexanedione, 2,2'-methyl enes[β -phenyl-, 1263².

C₂₅H₂₅O₂ Cyclohexanone, 2,6-bis(β -hydroxy benzal)-5-methyl-, diacetate, 1415².

Thebenone, monoperonal-, 2827².

C₂₅H₂₅O₂ Cyclopentanone, 2,5-bis(β -hydroxy benzal)-bis(ethylcarbonate), 1415².

C₂₅H₂₅On 3,5-Benzofurandiol, 1,2-dihydro-4

- (and 6) - ($\alpha, 3, 4$ - trihydroxybenzyl)-, pentaacetates, 454^{3, 4}.
- 4, 5, 7, 3', 4' - Flavanpentol, pentaacetate, 483³.
- C₂₁H₂₁HgN₂O₈ Leucomethylene blue, acetoxymercuribenzoate, 2482³.
- C₂₁H₂₁IN₂ Carboyanine, 1,1' - diethyl-, iodide, 289³, 1141³.
- C₂₁H₂₁NO₂ Crotonic acid, β - triphenylmethylamino-, Et ester, 2451³.
- C₂₁H₂₁N₂O₂ Glycine, *N* - (*N* - triphenylmethylglycyl)-(?), Et ester, 2479³.
- C₂₇H₂₇N₂O₂ Caproic acid, ϵ -benzamido - α - (6-methoxy - 4 - quinolylformyl)-, Et ester, 655³.
- C₂₁H₂₁N₂O₂ Benzofuran, 1,2 - dihydro - 3,5 - dimethoxy - 4 (and 6)-veratroyl-, phenylhydrazones, 484³.
- C₂₁H₂₁N₂O₂ Dinicotinic acid, 4-furyl - 1,2 - dihydro - 1,6 - dimethyl - 2 - (phenylcarbamylmethylene)-, di-Et ester, 2497³.
- C₂₁H₂₁O₄ Δ^1 - Cyclohexenecarboxylic acid, 6 - *o* - anisyl - 2 - keto - 4 - (*o*-methoxystyryl)-, Et ester, 450³.
- C₂₁H₂₁O₄ *o* Cresolsulfonephthalein, di-Et ether, 491³.
- C₂₁H₂₁O₅ Galactose, triphenylmethyl-, 2479³.
- d*-Glucose, 6-triphenylmethyl-, 2479³.
- C₂₁H₂₁O₇ *d*-Gluconic acid, triphenylmethyl-, *K* salt, 2479³.
- C₂₁H₂₁ClO₂ Anisole, 4, 1', 4'' - (chloromethenyl)-tris(2 - methyl-, 2486³.
- C₂₁H₂₁N₂O₂ Nicotinic acid, 5 - acetyl - 4 - *p* - anisyl - 1,6 - dihydro - 6 - keto - 1,2 - dimethyl-, Et ester, phenylhydrazone, 2497³.
- C₂₁H₂₁N₂O₄ 4, 5' - Bipyrrrole - 3 - carboxylic acid, 5 - formyl-4' - hydroxy-2,2' - dimethyl-, di-Et ester, acetate, γ - nitrophenylhydrazones, 75³.
- C₂₁H₂₁N₂O₄ 13 - Acridolineethanol, 12-acetyl-1,2,3,4,4i,7,12,13i - octahydro-, acetate, 296³.
- C₂₁H₂₁N₂O₅ Acetyl deriv. of compd. from dihydrobrucnic acid, m. 208-10°, 206³.
- C₂₁H₂₁N₂O₄ *d*-Glucose, 3-benzyl-, osazone, 2035³.
- C₂₁H₂₁O₄ Carbinol, tris(3 - methyl - *p* - anisyl)-, 2486³.
- C₂₁H₂₁AsN₂O₂ 2 - Quinuclidinecarbinol α -[6-(*p*-arsonophenylazo) - 7 - hydroxy - 4 - quinolyl] - 5 - ethyl, and *derivs.*, 2054⁷.
- C₂₁H₂₁NO₄ Ecgonine, benzoate, γ -phenyl propyl ester, 2343⁷.
- C₂₁H₂₁NO₄ Codeine, dihydrodesoxy-, salicylate, 297³.
- Ecgonine, tropate, benzyl ester, and chloroaurate, 2343⁷.
- C₂₁H₂₁AsBrO₆ 6 - Ethyl-6 - methylphenoxarsonium iodide, 6-bromocampforsulfonate, 2038³.
- C₂₁H₂₁N₂O₂ Spiro[cyclohexane - 1,4'(5') - furan-2'(3'),9'' - xanthen] - 5' - one, 3'',6''-bisdimethylamino-, 986⁴.
- C₂₁H₂₁N₂O₂ Brucinonic acid, hydrazone, Et ester, 522³.
- C₂₁H₂₁N₂O₁₀ Des - *N* - methyl-dihydrothebaineone, dihydro-, picrate, 2827³.
- C₂₁H₂₁CoN₂O₂ 940⁴.
- C₂₁H₂₁N₂O₂ Pyrrole, 2,2',2'' - methenyltris[4-acetyl - 3,5 - dimethyl-, 74⁷.
- C₂₁H₂₁N₂O₂ 2,9' - Spiro[1,2 - pyran - xanthen]-6(5) - one, 3',9' - bisdimethylamino-4,4-diethyl-3,4-dihydro-, 986⁴.
- C₂₁H₂₁N₂O₂ Dinicotinic acid, 1,2 - dihydro - 4 - isobutyl - 1,6 - dimethyl - 2 - (phenylcarbamylmethylene)-, di-Et ester, 2497³.
- C₂₁H₂₁N₂O₄ 4 - Isopyrrole-methylmalonic acid, 2-[4-(β , β - dicarboxyethyl)-2,5 - dimethyl-2 - pyrrolmethylene] - 3,5 - dimethyl-, tetra-Me ester, -HCl, 2823³.
- C₂₁H₂₁N₂O₁₁ Cuscohyaine, dihydro-, dipicrate, 1282³.
- C₂₁H₂₁NO₂ Cyclohexanecetic acid, α -hydroxy-, morphine salt, 982³.
- C₂₁H₂₁O₂ Oxidodianhydrostrophanthidinic acid, 2672³.
- C₂₁H₂₁NO₂ Oxidodianhydrostrophanthidinic acid ethylal, oxime, 2672³.
- C₂₁H₂₁BrNO₂ Acetophenone, α - (cyclohexylmethylamino)-, *d*- α -bromocampforsulfonate, 511³.
- C₂₁H₂₁O₂ α -Isostrophanthic acid, di-Me ester, 1143³.
- C₂₁H₂₁O₂ Dehydrodesoxycholic acid, Me ester, 640³.
- C₂₁H₂₁O₁₀ Tetrabasic acid, m. 265-7°, from digitonin, 1861³.
- C₂₁H₂₁O₂ Oleic alcohol, benzoate, 468⁷.
- C₂₁H₂₁ClO₂ Hyocholic acid, 4-chloro-, methyl ester, 2818³.
- C₂₁H₂₁NO₂ See *Delsoline*.
- C₂₁H₂₁NO₂ Aconine, -HCl, 2914³.
- Japacotine, -HCl, 2913³, 2924³.
- Jesacotine, -HCl, 2924³.
- C₂₁H₂₁O₂ Hyocholic acid, 4-hydroxy-, methyl ester, 2818³.
- C₂₁H₂₁BrN₂O₂ Phenanthraphenazinazine, bromodinitro-, 2208⁴.
- C₂₁H₂₁Br₂N₂O₂ Phenanthraphenazinazine, dibromonitro-, 2208⁴.
- C₂₁H₂₁BrN₂O₂ Phenanthraphenazinazine, bromonitro-, 2208⁴.
- C₂₁H₂₁Br₂N₂ Phenanthraphenazinazine, dibromo-, 2208⁴.
- C₂₁H₂₁N₂O₂ Phenanthraphenazinazine, dinitro-, 2208⁴.
- C₂₁H₂₁BrN₂ Phenanthraphenazinazine, 2-bromo-, 2208⁴.
- C₂₁H₂₁N₂O₂ Phenanthraphenazinazine, 2 (and 4)-nitro-, 2208⁴.
- C₂₁H₂₁ClN₂ Dibenzotriazolophenazine, 2 - (*p*-chlorophenyl)-, 1865³.
- C₂₁H₂₁N₂ Phenanthraphenazinazine, 2208⁴.
- C₂₁H₂₁N₂O Phenanthraphenazinazine, hydroxy-, 2208⁴.
- C₂₁H₂₁N₂O₂ Phenanthraphenazinazine, dihydroxy-, 2208⁴.
- C₂₁H₂₁O₄ 1,3 - Indandione, 2,2' - isophthalalbis-, 2947³.
- 2,2' - terephthalalbis-, 2947³.
- 1,2, α - Naphthopyrone - 4,3' - 1,2, β , β - naphthopyrone, 8241³.
- C₂₁H₂₁AsBr₂N₂O₂ Fluorescein, 4-(*p*-arsonophenylazo) - 2,7 - dibromo-, 647³.
- C₂₁H₂₁AsCl₂N₂O₂ Phenolphthalein, 3' - (*p*-arsonophenylazo)-3,4,5,6-tetrachloro-, 2647³.
- C₂₁H₂₁N₂ Dibenzotriazolophenazine, 2 - phenyl-, 1865³.
- Phenanthraphenazinazine, 2-amino-, 2208⁴.
- C₂₁H₂₁Br₂Cl₂O₂ *o* - Cresolphthalein, dibromotetrachloro-, diacetate, 1268³.
- C₂₁H₂₁Br₂N₂O₂ Benzidine, *N,N'* - bis(3,5-dibromosalicylal), 250³.
- C₂₁H₂₁Br₂N₂ *o*-Tetrazine, 1,4-bis(2,4-dibromophenyl) - 1,4-dihydro - 3,6 - diphenyl-, 2332³.

- C₂₁H₁₄Br₂O₂ Dioxanthone perbromide, 516¹.
 C₂₁H₁₄Cl₄N₂O₂ *o*-Cresolphthalein, tetrachloro-
 dinitro-, diacetate, 266¹.
 C₂₁H₁₄HgN₂O₂ Salicylic acid, mercuribisnitro-
 benzenazo-, 2422¹.
 C₂₁H₁₄N₂O₂ Benzenophenazine, 6 - (2 - naph-
 thylsulfonyl)-, 3083¹.
 Perimidine - [Δ⁹(7), Δ¹⁰(8)] - thionaphthene-
 2,7 - dione, 2 - methyl - 1 - phenyl-,
 2637¹.
 C₂₁H₁₄N₂ Dibenzofluorindine, 1283¹.
 C₂₁H₁₄N₂O₂ 1,2,5 - Triazole - 3 - *o* - benzoic
 acid, 1,1' - *p* - phenylenebis[4 - carboxy-,
 1866¹.
 C₂₁H₁₄O₂ Δ⁹, Δ¹⁰ - Bixanthene, 1423¹.
 C₂₁H₁₄O₂ 2,2' - Spiro[indan - Δ⁹, Δ¹⁰ - biindan]-
 1,1', 3',3'-trione, 494¹.
 C₂₁H₁₄O₂ 3 - Isoxanthone, 6 - hydroxy - 9 -
 phenyl-, benzoate, 1567¹.
 C₂₁H₁₄O₂ Naphthalic acid, 4 - (2 - phenyl-
 phthalidyl)-, 2452¹.
 C₂₁H₁₄AsN₂O₂ Fluorescein, 2(*p*-arsonophenyl-
 azo)-, 2642¹.
 C₂₁H₁₄NO₂ Compd. from 1 - (3 - hydroxy - 4 -
 keto - 1(4) - naphthylidene - 2(1) - thio-
 naphthenone and Me anthranilate, 2493¹.
 C₂₁H₁₄N₂O₂ α, γ, α' - Tribenzenophenazine, 11-
 acetamido-, 2201¹.
 C₂₁H₁₄N₂O₂ Acridan, 10-methyl - 1,3,7,9 -
 tetranitro - 5,5 - diphenyl-, 1280¹.
 C₂₁H₁₄Br₂Cl₂CuN₂O₂ Formamidine, *N*(and *N'*)-
 (*p*-bromophenyl) - *N'*(and *N*) - (*p*- chloro-
 phenyl) - *N* - hydroxy-, Cu salt, 978¹.
 C₂₁H₁₄Br₂N₂ *s*-Tetrazine, 1,4 - bis(*p* - bromo-
 phenyl) - 1,4 - dihydro - 3,6 - diphenyl-,
 2332¹.
 C₂₁H₁₄Br₂N₂O₂ Bibenzyl, *p*, *p'* - azoxy - α, α' -
 dibromo - α, α' - bis(*N* - nitrosoanilino)-,
 482¹.
 C₂₁H₁₄Br₂O₂ Benzopinacol, *p*, *p'*, *p''*, *p'''*-tetra-
 bromo-, 273¹.
 C₂₁H₁₄Cl₄N₂ Diphenitidyl chloride, *N*, *N'*-
 diphenyl-, 1703¹.
 C₂₁H₁₄Cl₄O₂ *o*-Cresolphthalein, tetrachloro-,
 diacetate, 1267¹.
 C₂₁H₁₄NO₂ 2(1) - Thionaphthenone, 1-(7-
 acetamido - 4 - anilino - 1 - keto - 2(1) -
 naphthylidene)-, 2338¹.
 C₂₁H₁₄N₂O₂ Hydroquinol, 2 - phenylazo-, di-
 benzoate, 44¹.
 C₂₁H₁₄N₂O₂ Hydroquinol, 2-phenylazoxy-, di-
 benzoate, 44¹.
 C₂₁H₁₄N₂O₂ Acridan, 10-methyl-3,7,9 - trinitro-
 5,5-diphenyl-, 1280¹.
 C₂₁H₁₄N₂O₂ Stilbene, *p*, *p'* - azoxy - α, α' - bis-
 (*N*-nitrosoanilino)-, 482¹.
 C₂₁H₁₄O₂ Phthalide, 2-α(3 - acetaphenyl) - 2 -
 phenyl-, 652¹.
 C₂₁H₁₄O₂ 2(1) - β - Naphthofurazone, 1 - phen-
 acyl - 1 - phenyl-, 1277¹.
 C₂₁H₁₄O₂ 1,9 - Benzodi - 1,4 - pyran - 4,6 - dione,
 2,8 - dibenzyl-, 517¹.
 C₂₁H₁₄AsN₂O₂ Naphthalic acid, 4 - (*o* - carboxy-
 benzohydryl)-, 652¹.
 C₂₁H₁₄AsN₂O₂ Phenolphthalein, 3' - (*p* - arsono-
 phenylazo)-, 2647¹.
 N₂O 2 - Quinoxalinol, 7 - chloro-1,2 -
 dihydro - 1,2,3 - triphenyl-, and per-
 chlorate, 643¹.
 C₂₁H₁₄O₂ 2(2 and 4) - (3,4 - Dihydroxystyryl)-
 7-hydroxy - 4(2 and 3) - (3,4 - methylene-
 dioxytyryl)benzopyrylium chloride, 1708¹.
 C₂₁H₁₄N₂O₂ Benzamide, 2nd hydroxy - 5 - phenyl-,
 benzoate, 1859¹.
 C₂₁H₁₄N₂O₂ Phthalimidine, 3 - (*p* - hydroxy-
 phenyl)-3-(4 - hydroxy - *p* - phenylazo-
 phenyl)-, 273¹.
 C₂₁H₁₄N₂O₂ Acridan, 10-methyl-3,7-dinitro-5,5-
 diphenyl-, 1280¹.
o - Toluic acid, α - (4 - hydroxy - 6 - phenyl-
 asophenyl) - α - (*p*-keto-*p*-phenylidene)-,
 oxime, 273¹.
 C₂₁H₁₄Br₂Cl₂O₂ Phthalide, 2,2 - bis(bromo-3 -
 methyl - *p* - phenetyl) - 3,4,5,6 - tetra-
 chloro-, 1268¹.
 C₂₁H₁₄Br₂N₂O₂ Bibenzyl, α, α' - dianilino - *p*, *p'* -
 azoxy - α, α' - dibromo-, 482¹.
 C₂₁H₁₄Cl₂O₂ Isophthalic acid, 4,6 - bis(chloro-
 tolyl)-, di-Me ester, 627¹.
 Terephthalic acid, 2,5-bis(chlorotolyl)-, di-
 Me ester, 627¹.
 C₂₁H₁₄CuN₂O₂, 2173¹.
 C₂₁H₁₄N₂O₂ Acridan, 10-methyl-3-nitro-5,5-di-
 phenyl-, 1280¹.
 Diphenanilide, 1703¹.
 Indole, 3,3' - phthalylbis[2-methyl-, 2823¹.
o - Toluic acid, α - (2 - methyl - 3 - indyl)-α -
 (2 - methyl - 3 - *p*-acetoindylidene)-, and
 K salt, 2823¹.
 C₂₁H₁₄N₂O₂ Diphenamic acid, *N*-[*p*-(*p*-amino-
 phenyl)phenyl], 2196¹.
 C₂₁H₁₄N₂O₂ 1,4 - Naphthoquinone, 2,3-bis-
 (*N* - acetylanilino)-, 2821¹.
 C₂₁H₁₄N₂O₂ Stilbene, α, α' - dianilino - *p*, *p'* -
 azoxy-, and *HCl*, 481¹, 482¹.
 C₂₁H₁₄N₂O₂ Benzaldehyde, nitro-, α, α' - (*p*, *p'*-
 biphenylene)bishydrazone, 3259¹.
 C₂₁H₁₄O₂ 3, α - Acenaphthene - *o* - toluic acid,
 α - phenyl-, 652¹.
 Naphthalene, 1,8-ditolyl(-?), 497¹.
 2,1,3 - *peri* - Naphthopyrone, 3,3 - di-
 tolyl(-?), 497¹.
 Phthalide, 2,2 - bis(2 - methyl - 3 - indyl)-,
 2823¹.
 C₂₁H₁₄O₂ Arabonic acid, γ - lactone, tribenzoate,
 817¹.
 C₂₁H₁₄Br₂O₂ + 2H₂O, Compd., m. 130-68°,
 from 3-bromopyromellitic anhydride and
p-xylene, 1275¹.
 C₂₁H₁₄O₂ 2 - (*p* - Methoxystyryl) - 4,6 - di-
 phenylpyrylium chloride, FeCl₃ compd.,
 519¹.
 C₂₁H₁₄O₂ 7 - Hydroxy - 2(2 and 4) - (*p*-hydroxy-
 styryl) - 4(2 and 2) - (*p* - methoxystyryl)-
 benzopyrylium chloride, 1707¹, 1708¹.
 C₂₁H₁₄O₂ 2(2 and 4) - (3,4 - Dihydroxystyryl)-
 7 - hydroxy - 4(2 and 2) - (*p* - methoxy-
 styryl)benzopyrylium chloride, 1708¹.
 C₂₁H₁₄O₂ (*p* - Methoxystyryl)diphenylpyrylium
 perchlorate, 519¹.
 C₂₁H₁₄N₂O₂ Acridan, 10 - methyl - 5,5 - diphenyl-,
 1280¹.
 C₂₁H₁₄NO 9-Carbazoleethanol, α, α - diphenyl-,
 2827¹.
 C₂₁H₁₄NO₂ Pyrrole, 3,4 - dibenzoyl - 2,5 - di-
 methyl - 1 - phenyl-, 502¹.
 C₂₁H₁₄N₂O₂ Phthalimidine, 2 - acetyl - 3 - (*p*-
 hydroxyphenyl)-3-salicyl-, diacetate, 272¹.
 C₂₁H₁₄N₂O₂ Benzamide, amino - *N*, *N'* - 4-
 phenyl-, *Bz* deriv., 645¹.
 C₂₁H₁₄N₂O₂ Anhydridiacetyl-dibenzylaminophthal-
 imidine, 261¹.
 Benzidine, acetyl - *N*, *N'* - diphenyl-, 255¹.
 C₂₁H₁₄N₂O₂ 1,4 - Naphthalenediol, 2,3-dianilino-,
 diacetate, 2824¹.
 C₂₁H₁₄N₂O₂ Phthalimidine, 2 - acetamido - 3,3 -
 bis(*p* - hydroxyphenyl)-, diacetate, 272¹.
 C₂₁H₁₄N₂O₂ Benzamide, *N* - [2 - (α, β - diket-

- homopiperonyl) - 4,5 - dimethoxyphenethyl - *o* - nitro - (?), 520⁹.
- 5,5' - Spirobi[*m* - dioxan] - 2 - *ol*, 2' - (*o* - nitrophenyl) - 2⁹ (*o* - nitrosophenyl) - benzate, 2932⁹.
- C₂₈H₃₅N₄O₈ Benzaldehyde, α,α' - (*p,p'* - biphenylene)bishydrazone, 3259¹.
- C₂₈H₃₅N₄O₈ Salicylaldehyde, α,α' - (*p,p'* - biphenylene)bishydrazone, 3259¹.
- C₂₈H₃₅N₄O₇ Naphthocarbazole, hexahydro-, picrate, 1273⁹.
- C₂₈H₃₅N₄O₄ Pyocyanin, dinitrosamine, 1864².
- C₂₈H₃₅O₆ Methane, anisyltriphenyl-, 2947¹.
- C₂₈H₃₅O₅ *p,p'* - Biphenol, di-*p*-toluenesulfate, 2483².
- C₂₈H₃₅O₁₁ Ellagic acid, tetracarboethoxy-, 1324⁴.
- C₂₈H₃₅AsI₄ Benzyltriphenylarsonium iodide, CHI₃ addn. compd., 1403⁹.
- C₂₈H₃₅ClO₄ 4 - (*p* - Hydroxystyryl) - 3,5,7-trimethoxy - 2 - phenylbenzopyrylium chloride, 1707⁷.
- C₂₈H₃₅Cl₂N₂O₂ Addn. compd. of diphenylamine and trichloroacetic acid, 3199⁹.
- C₂₈H₃₅NO₄ 1,1' - Bi - 2(1) - benzofuranone, 1-anilino - 3,5,3',5' - tetramethyl-, 2046⁴.
- C₂₈H₃₅NO₇ Benzamide, *N* - [2 - (α,β - diketo-homopiperonyl) - 4,5 - dimethoxyphenethyl] - (?), 520⁹.
- , *N* - [6 - (α - keto - 3,4 - dimethoxyphenacyl) homopiperonyl - (?), 520⁹.
- Valeric acid, δ -amino- α,γ -dihydroxy-, tri-Bz deriv. 635⁹.
- C₂₈H₃₅N₂ Bibenzyl, α,α' -dianilino-, 519⁵.
- C₂₈H₃₅N₂O₂ Glutaramide, α -methyl-*N,N'*-di-2-naphthyl-, 2477².
- Phthalimide, 2-acetyl-1-(acetylmino) 3,3-dibenzyl-, 261¹.
- C₂₈H₃₅N₂O₄ 5-Iso-2,3- γ -indoloquinoline, 2,3,9,10-tetramethoxy - 5 - methyl - 6 - phenyl-, 2956⁷.
- C₂₈H₃₅N₂O₅ 1,6 - Pyridopyridine - 3 - carboxylic acid, 4 - *p* - anisyl - 1,5,6,7 - tetrahydro-5,7 - diketo - 1,2 - dimethyl - 6 - phenyl-7-thio-, Et ester, 2497⁷.
- C₂₈H₃₅N₂O₅ 1,6 - Pyridopyridine - 3 - carboxylic acid, 4 - *p* - anisyl - 1,5,6,7 - tetrahydro-5,7 - diketo - 1,2 - dimethyl - 6 - phenyl-Et ester, 2497⁷.
- C₂₈H₃₅N₂O₅S₂ Phenylenediamine, naphthalenesulfonate, 650⁹.
- C₂₈H₃₅N₂O₇ Benzamide, *N* - [2 - (α,β - diketo-homopiperonyl) - 4,5 - dimethoxyphenethyl] - (?), oxime, 520⁹.
- C₂₈H₃₅N₂O₈ 2568¹.
- C₂₈H₃₅N₂ Benzylamine, *o,o'*-azobis[*N*-phenyl-, 481¹.
- C₂₈H₃₅N₂O Benzylamine, *o,o'* - azoxybis[*N*-phenyl-, 481¹.
- C₂₈H₃₅N₂O₂ Glyoxal, 8-hydroxy(2-hydroxy-1-naphthyl)-, bisphenylhydrazone, 64⁹.
- Pyocyanin, 302⁹; and chloraurate, 1864².
- C₂₈H₃₅O Ether, methyl dimethyl- α -1-naphthylbenzohydryl-, 2045².
- C₂₈H₃₅BrN₂O₂ 2 - Isoquinolinecarbinol, 1-(6-bromoveratryl)-1,2,3,4 - tetrahydro-6,7-methylenedioxy-, picrate, 2660⁹.
- C₂₈H₃₅NO₄ Propiophenone, 3,4-dimethoxy- β -salicyl-, benzoate, oxime, Ac deriv. 1260⁴.
- C₂₈H₃₅NO₅ Bulbocapnine, phenylsulfonyl-, Me ether, 990⁴.
- C₂₈H₃₅OdN₂O₂ Carbazide, cadmium-didiphenyl-, 2056².
- C₂₈H₃₅N₂O₂ Apocynine benzoate, *ddi-HCl*, 2056².
- C₂₈H₃₅N₂ Benzyl *o,o'* - hydrazobis[*N*-phenyl-, 481¹.
- C₂₈H₃₅N₂O₂ Addn. compd. of dimethylketene and *p*-nitrophenyl isocyanate, 2189¹.
- C₂₈H₃₅N₂O₄ Papaverine, 3,4-dihydro-, picrate, 520⁹.
- C₂₈H₃₅N₂O₄ Ketone, 1-methyl-2-piperidyl 4-quinolyl, picrolonate, 656⁹.
- C₂₈H₃₅N₂O₇ Ketone, 6-methoxy-4-quinolyl methyl - 2 - pyrrolidyl, monopicrolonate, 657¹.
- C₂₈H₃₅N₂O₂Zn Carbazide, zinc-didiphenyl-, 256⁹.
- C₂₈H₃₅O₂ Cyclohexanone, 2,6-bis(*p* - hydroxybenzyl)-, bis(ethylcarbonate), 1415².
- C₂₈H₃₅NO₄ Thebaine, piperonylidenedihydro-, 2827².
- C₂₈H₃₅NO₅S Corydine, phenylsulfonyl-, 990⁴.
- C₂₈H₃₅NO₂ Phenol, 3,5 - dimethoxy - 2 - [γ -(3,4-dimethoxyphenyl)propyl]-, *p*-nitrobenzoate, 2041².
- C₂₈H₃₅N₂O₂S Thiazolidine, methyl-3 - (2,5-xylyl)-2-(2,5 - xylylimino)-, picrate, 2481⁵.
- C₂₈H₃₅Br₂N₂O Phenol, 2,4-bis(5-bromo-2-carvacrylazo)-, 641⁷.
- C₂₈H₃₅Cl₂N₂O Thymol, 2,6-bis(4-chloro-2,5-xylylazo)-, 255².
- C₂₈H₃₅N₂O₄ Caproic acid, ϵ - *N* - methylbenzamide - α - 4 - quinolylformyl-, Et ester, 656⁷.
- C₂₈H₃₅N₂O₅S₂ *o*-Tolidine, benzenesulfonate, 651².
- C₂₈H₃₅N₂O₅S₂ Bianisidine, benzenesulfonate, 651².
- C₂₈H₃₅N₂O₅S₂ Naphthalenedisulfonic acid, γ -benzylthiopseudouracil salt, 495⁹.
- C₂₈H₃₅N₂O₁₁ 7 - Isoquinolinal, 1,2,3,4 - tetrahydro - 6 - methoxy - 1 - (α - methylveratryl)-, picrate, 2669⁹.
- C₂₈H₃₅N₂O₁₂ 1 - Isoquinolinal, 2 - (2,3 - dimethoxybenzyl)-, 2,3,4 - tetrahydro-6,7-dimethoxy-, picrate, 2668⁷.
- C₂₈H₃₅N₂O₈ Quinine amine, picrate, 2055⁴.
- C₂₈H₃₅O₂ Glucoside, methyltriphenylmethyl-, 2505⁴.
- C₂₈H₃₅O₅ Epicatechol, tetramethyl-, *p* - toluenesulfonate, 1259⁹.
- C₂₈H₃₅BrN₂O Quinine, *p*-bromophenylhydrazone, 2055⁴.
- C₂₈H₃₅N₂O₅S Quinine - amine, *N* - benzenesulfonate, 2055⁴.
- C₂₈H₃₅CdN₂O₄ Carbazide, cadmium-diaquo-didiphenyl-, 256⁹.
- C₂₈H₃₅N₂O₂Zn Carbazide, zinc diaquo - didiphenyl-, 257¹.
- C₂₈H₃₅O₂ Cyclohexanol, 2,6 - bis(*p* - hydroxybenzyl)-, triacetate, 1415².
- C₂₈H₃₅Cl₂MnN₂ 1385⁶.
- C₂₈H₃₅N₂O₂ Spiro[cyclohexane - 1,4'(3') - 1,2-pyran - 2',9'' - xanthen] - 6'(5') - one, 3'',6''-bisdimethylamino-, 986⁴.
- C₂₈H₃₅N₂O₂ Echitamine, diacetate, *HCl*, 2058².
- C₂₈H₃₅N₂O₅ 1,2,3,4 - Tetrazinetetracarboxylic acid, hexahydro-5,5 - diphenyl-, tetra-Et ester, 1425².
- C₂₈H₃₅NO₄ Lobelanidine, diacetate, 2828².
- C₂₈H₃₅N₂O₄ Pyrrolecarboxylic acid, 4 - [bis(4-acetyl - 3,5 - dimethyl - 2 - pyrrol)-methyl]dimethyl-, Et ester, 749².
- C₂₈H₃₅N₂O₄ 3 - Pyrrolecarboxylic acid, 5,5' - [5-(ethoxymethyl) - 2 - furylmethyl]bis[2,4 - dimethyl-, di-Et ester, 75¹.
- C₂₈H₃₅BrO₂ 2476⁸

- C₂₇H₄₄O₁₇**: Lactose, acetyl- α -chloro-, 2476.
C₂₇H₄₄O₁₇: Lactose, acetyl- α -chloro-, 2476.
C₂₇H₄₄O₁₇: Diphenic acid, β -bis(diethylaminoethyl) ester, 1703.
C₂₇H₄₄O₁₇: Acid from digitonin, 1861.
C₂₇H₄₄O₁₇: Tri-Me ester, m. 132°, of the anhydride acid from pyrocholoidanic acid, 1854.
C₂₇H₄₄O₁₇: Lupulone, 2042.
C₂₇H₄₄O₁₇: Bi-Me ester, m. 109°, of acid from the tri-Me ester of hyodesoxybilianic acid, 1429.
 Hyodesoxybilianic acid, lactone, di-Me ester, 1429.
C₂₇H₄₄O₁₇: Tribasic acid, m. 217-20°, from gito-genic acid, 3483.
C₂₇H₄₄O₁₇: Pentabasic acid, m. 221-3°, from digitonin, 1861.
C₂₇H₄₄O₁₇: Dehydrodesoxycholic acid, Et ester, 641.
C₂₇H₄₄O₁₇: Di-Et ester, m. 134°, of acid from gito-genic acid, 3483.
 Citogenetic acid, 3483.
C₂₇H₄₄O₁₇: Glycocholic acid, 527.
C₂₇H₄₄O₁₇: Taurocholic acid, 527.
C₂₇H₄₄O₁₇: Succinic acid, α , β -dimethoxy-, di-methyl ester, 248.
C₂₇H₄₄O₁₇: Co₂N₂O₁₀ + 10H₂O, 68.
C₂₇H₄₄O₁₇: Cl₂N₂O₁₀, 2790.
C₂₇H₄₄O₁₇: Cutic acid, 3291.
C₂₇H₄₄O₁₇: Hexacosane, 889.
C₂₇H₄₄O₁₇: 9-Fluorenone, 2,7-dihydroxy-, di-benzoate, 2657.
C₂₇H₄₄O₁₇: Naphthac acid, 4-[β -(p -carboxyphenyl)phthalidyl]-, 652.
C₂₇H₄₄O₁₇: 2'-Flavindulinicarboxylic acid, chloride, 294.
C₂₇H₄₄O₁₇: Benzene, *s*-tri- p -anisyl-, hexabromo deriv., 3265.
C₂₇H₄₄O₁₇: 6,7-f-Indoloquinoline, 7,8-diphenyl-, 2959.
C₂₇H₄₄O₁₇: Benzene, α -tri- p -anisyl-, penta-bromo deriv., 3264.
C₂₇H₄₄O₁₇: 2(5) - Acridone, 7 - hydroxy - 5,5 - diphenyl, acetate, 1280.
C₂₇H₄₄O₁₇: Imidazole, 2 - [*m*-(2,4 - dihydroxyphenylazo)phenyl] - 4,5 - diphenyl-, 2494.
C₂₇H₄₄O₁₇: Carbinol, di-1-naphthylsalicyl-, 2945.
C₂₇H₄₄O₁₇: Δ^3 - Cyclopentenone, 2 - methyl - 4-(3,4-methylene-dioxypheyl) - 3 - phenyl-5-piperonylidene-, 2934.
C₂₇H₄₄O₁₇: Diphenyl - 2 - (β - styrylvinyl)-pyrylium chloride, FeCl₃ compd., 519.
C₂₇H₄₄O₁₇: Diphenyl - (β - styrylvinyl)pyrylium perchlorate, 519.
C₂₇H₄₄O₁₇: 7 - Hydroxy - 4 - (4 - hydroxy - 3 - methoxystyryl) - 2 - (3,4 - methylenedioxy-styryl)benzopyrylium chloride, 1708.
C₂₇H₄₄O₁₇: Benzylamine; α , α - di - 1 - naphthyl-, 1704.
C₂₇H₄₄O₁₇: 2(5) - Acridone, 7(of 9) - acetamido-9(er 7) - amino-5,8-diphenyl-, 1280.
C₂₇H₄₄O₁₇: Hydrazine, β - benzyl - α - diphenyl-acetyl- α -phenyl-, 1284.
C₂₇H₄₄O₁₇: Imazole, 3,5-bis(2 - methylindyl)-1- α -phenyl-, 2433.
C₂₇H₄₄O₁₇: 3, α - Acenaphthene- α -toluic acid, α -phenyl-, Me ester, 652.
 - α , β -tolyl-, 643.
C₂₇H₄₄O₁₇: 7 - Hydroxy - 2 - bis(p -methoxy-styryl)benzopyrylium chloride, 1707.
C₂₇H₄₄O₁₇: Benzamide, N - α -(2-hydroxybenzo-hydroxy)benzyl-, 3254.
C₂₇H₄₄O₁₇: Carbanilide, bis[α -(α -phenyl- β -[α -(p -tolyl)benzo-hydroxy]- 642.
C₂₇H₄₄O₁₇: Methane, (dimethoxyphenyl)triphenyl-, 2947.
C₂₇H₄₄O₁₇: Benzene, *s*-tri- p -anisyl-, 3264.
 Δ^3 - Cyclopentenone, 2 - anisal - 3 - p -anisyl-5-methyl - 4 - phenyl-, 2934.
C₂₇H₄₄O₁₇: Copteryne - 4 - carboxylic acid, 2,6,7,8 - tetrahydro - 6,8 - diketo - 2,3 - dimethyl - 7 - phenyl - 1 - (phenylcarbamylmethyl)-, Et ester, 2497.
 1,6 - Pyridopyridine - 3 - carboxylic acid, 1,5,6,7 - tetrahydro - 5,7 - diketo - 1,2 - dimethyl - 6 - phenyl - 4 - (phenylcarbamylmethyl)-, Et ester, 2497.
C₂₇H₄₄O₁₇: Anthracene, 7 - benzyl - 1,2,3,4,5,6-hexahydro-, picrate, 1273.
C₂₇H₄₄O₁₇: Thiazole, 5,8 - (dimethylamino-benzal)bis[2 - amid - 4 - phenyl-, 513.
C₂₇H₄₄O₁₇: 4 - (β - Dimethylaminostyryl)-5,7-dimethoxy - 2 - phenylbenzopyrylium chloride, and FeCl₃ compd., 1707.
C₂₇H₄₄O₁₇: Carbazide, mercuridibenzyl-mercuridiphenyl-, 256.
C₂₇H₄₄O₁₇: Glutaramide, α , γ - dimethyl - *N*, *N'*-dinaphthyl-, 2477.
C₂₇H₄₄O₁₇: Citric acid, triphenyl ester, P 2673.
C₂₇H₄₄O₁₇: Benzamide, *N* - [2 - (α - keto - 3,4-dimethoxyphenacyl) - 4,5 - dimethoxyphenethyl]-(?), 521.
C₂₇H₄₄O₁₇: Dinicotinic acid, 1,2-dihydro-1,6-dimethyl - 4 - (*m* - nitrophenyl) - 2 - (phenylcarbamylmethylene)-, di-Et ester, 2497.
C₂₇H₄₄O₁₇: Addn. compd. of *p*,*p'* - bis(dimethylamino)benzophenone and naphthol, 1265.
C₂₇H₄₄O₁₇: 2,3 - γ - Indoloquinoline, 2,3,9,10-tetramethoxy - 6 - phenyl-, methosulfate, 2956.
C₂₇H₄₄O₁₇: Bufagein, 126.
C₂₇H₄₄O₁₇: Pyruvic acid, β , β' - heptylidenebis[β -benzoyl-, di-Et ester, 165.
C₂₇H₄₄O₁₇: Carbocyanine, 1,1' - diethyldimethyl-, iodide, 289, 1141.
C₂₇H₄₄O₁₇: Corydine, phenylsulfonyl-, Me ether, 990.
C₂₇H₄₄O₁₇: Phenylmorpholine green, 2207.
C₂₇H₄₄O₁₇: Isoquinoline, 2 - (2,3 - dimethoxybenzyl) - 1,2,3,4 - tetrahydro - 6,7 - dimethoxy - 1 - methyl-, picrate, 2668.
C₂₇H₄₄O₁₇: Salicin, tetraacetate, Ph ether, 3088.
C₂₇H₄₄O₁₇: Datisic, 2514.
C₂₇H₄₄O₁₇ + 2H₂O Rutin, 927.
C₂₇H₄₄O₁₇: Cu₂O₁₀, 217.
C₂₇H₄₄O₁₇: Des - *N* - methylidihydrothebainone, dihydro-, piperonylidene deriv., 2827.
C₂₇H₄₄O₁₇: Quinotoxin α -amine, benzoate, 2055.
C₂₇H₄₄O₁₇: Acetophenone, α - (1,2,3,4-tetrahydro - 1 - quinolyl)-, 4- α -bromo-camphorsulfonate, 511.
C₂₇H₄₄O₁₇: Des - *N* - methylidihydrothebainone, dihydro-, α deriv., picrate, 2827.
C₂₇H₄₄O₁₇: Blurea, α -heptyl - β , α' , β' -triphenyl-dithio-, 3478.
C₂₇H₄₄O₁₇: Tricarballic acid, trihydroxy-, tri(p - tolylsulfonylhydrazide)(?), 260.
C₂₇H₄₄O₁₇: Anthranilrhodamine, 2197.
C₂₇H₄₄O₁₇: Aniline, α - hydroxybenzalbin-*N*, *N* - diethyl-*p* 77.
C₂₇H₄₄O₁₇: Dicumyl deriv., m. 102°, 2933.
C₂₇H₄₄O₁₇: Bufagein, 126.

- C₁₇H₁₅N₂O₃ 3 - Pyrrolicarboxylic acid, 5,5' - (4-acetyl - 3,5 - dimethyl - 2 - pyrrolylmethyl-ene)bis[2,4 - dimethyl-, di-*Et* ester, 74^a.
 C₁₇H₁₅O₃ Bufaginic acid, 126^a.
 C₁₇H₁₅O₁₁ Maltoside, heptaacetylmethyl-, 2034^a.
 C₁₇H₁₅N₂O₂ Ketone, 1 - (hydroxymethyl) - 2,4 - dimethyl-3-pyrrolylmethyl, trimer, 2336^a.
 C₁₇H₁₅O₂ Elemonic acid, and *Na* salt, 269¹.
 C₁₇H₁₅O₂ Elemolic acid, and salts, 268^a, 269¹.
 C₁₇H₁₅O₂ Desoxybiliaric acid, tri-Me ester, 641¹, 1429^a.
 Hydodesoxybiliaric acid, tri-Me ester, 1429^a.
 C₁₇H₁₅O₂ Anhydride, m. 154-4.5°, of acid from sitosterol, 474^a.
 C₁₇H₁₅NO₂ Sitostene, nitro-, 474^a.
 C₁₇H₁₅ Sitostene, 474^a.
 C₁₇H₁₅O (See also *Cholesterol*; *Sitosterol*).
 Heterositostanone, 474^a.
 C₁₇H₁₅O₄ Acid, m. 278° (decompn.), from sitosterol, 474^a.
 C₁₇H₁₅NO Heterositostanone, oxime, 474^a.
 C₁₇H₁₅Br₂CoN₂O₁₀S₂, 68^a.
 C₁₇H₁₅Br₂ClCoN₂O₁₀S₂ + 2H₂O, 67^a.
 C₁₇H₁₅O₂ Acid from Rhenish brown coal, 1768^a.
 C₁₇H₁₅O 14-Heptacosanoic acid, 1692^a.
 C₁₇H₁₅O₂ Cerotic acid, 741^a, 2571^a, 3081^a, 3396^a.
 C₁₇H₁₅ Heptacosane, 1692^a.
 C₁₇H₁₅O Heptacosanol, 841^a.
 C₁₇H₁₅Cl₂O₂ Helianthrene, 1,4,5,8,10,15-hexachloro-, 1571^a.
 C₁₇H₁₅N₂O Indanthrene, P 403^a.
 C₁₇H₁₅O₂ Helianthrene, 1571^a.
 C₁₇H₁₅O₄ 1,1'-Bianthraquinone, 1571^a.
 C₁₇H₁₅Br₂CoN₂O₁₀S₂ Disalicylicboric acid, Ba salt, 2179¹.
 C₁₇H₁₅Br₂CoN₂O₁₀S₂ + 10H₂O Disalicylicboric acid, Ca salt, 2179¹.
 C₁₇H₁₅Br₂CoN₂O₁₀S₂ + 10H₂O Disalicylicboric acid, Co salt, 2179¹.
 C₁₇H₁₅Br₂CoN₂O₁₀S₂ + 10H₂O Disalicylicboric acid, Cu salt, 2179¹.
 C₁₇H₁₅Br₂MgO₁₀S₂ + 10H₂O Disalicylicboric acid, Mg salt, 2179¹.
 C₁₇H₁₅Br₂MnO₁₀S₂ + 10H₂O Disalicylicboric acid, Mn salt, 2179¹.
 C₁₇H₁₅Br₂O₁₀Pb Disalicylicboric acid, Pb salt, 2179¹.
 C₁₇H₁₅Br₂O₁₀Sr Disalicylicboric acid, Sr salt, 2179¹.
 C₁₇H₁₅O₄ Δ¹⁰, 10' - Bianthrene, 3,6' - dihydroxy-, 3269^a.
 Fumaric acid, dinaphthacyl-, dilactone, 486^a.
 C₁₇H₁₅Br₂ Fluorene, 9,9' - (s - dibromoethyl-ene)bis[9 - bromo-, 2334^a.
 C₁₇H₁₅ClN Phenanthrenephenazonium chloride, N-phenyl-, 2954^a.
 C₁₇H₁₅N₂O Phenanthrenequinone, 2,7 - bis(benzalamino)-, 2491^a.
 C₁₇H₁₅N₂O Phenanthrenequinone, 2,7 - bis(salicylalamino)-, 2491^a.
 C₁₇H₁₅N₂ Benzofluorindine, phenyl-, 1283^a.
 C₁₇H₁₅N₂O₂ Dye, sulfur blue, 1574^a.
 C₁₇H₁₅O₄ 2,2' - Bi - (1(2) - benzofuranone, 2,2' - diphenyl-, 1277¹, 2043^a.
 C₁₇H₁₅O₂ Naphthalic acid, 4 - [2 - (p - carboxyphenyl)phthalidyl] -, Me ester, 652^a.
 C₁₇H₁₅N₂O Pseudoindoxyl, 2,2 - di - 1 - naphthoxy-(?), 1572¹.
 C₁₇H₁₅N₂ Rosinduline, phenyl-, P 3492^a.
 C₁₇H₁₅ 2,1 - Indenoindene, 5,10 - dihydro - 5,10 - diphenyl-, 2458^a.
 C₁₇H₁₅Br₂Cr₂N₂O₁₀S₂ + 6H₂O, 67^a.
 C₁₇H₁₅Br₂N₂O₂ 0 - Tolidine, N, N' - bis(3,5 - dibromosalicyl-), 2597^a.
 C₁₇H₁₅Br₂N₂O₄ Benisidine, N, N' - bis(3,5 - dibromosalicyl-), 2597^a.
 C₁₇H₁₅Cr₂N₂O₁₀S₂ + 6H₂O, 67^a.
 C₁₇H₁₅Cl₂N₂O₁₀S₂ Methylenebis(disulfide, monochloromonohydroxy-, 1574^a.
 C₁₇H₁₅N₂ Succinonitrile, tetraphenyl-, 1858^a.
 C₁₇H₁₅N₂O Imidazole, 2 - (m - hydroxyphenyl) - 4,5 - diphenyl-, benzoyl deriv., 2454^a.
 C₁₇H₁₅N₂O₂ Glyoxylic acid, dioxanthylhydraz and Ag salt, 3480^{1,2}.
 C₁₇H₁₅N₂O₂ Phthalamic acid, N, N' - p - bi-phenylenebis-*p* 2196^a.
 C₁₇H₁₅N₂ Benzothiazole, 1,1' - (azodi - p - phenylene)bis[5 - methyl-, 284^a.
 C₁₇H₁₅N₂O₂ Phthalide, 2 - (2,3 - bisphenylazo-2-pyrrolyl) - 2 - (2 - pyrrolyl)-(?), 2951^a.
 C₁₇H₁₅N₂O₁₀S₂ α - Toluaniide, ar', ar''' - dithio-bis-, tetranitro deriv., 816¹.
 C₁₇H₁₅O₂ Benzilide, 2659^a.
 C₁₇H₁₅ 2,1 - Indenoindene, 4,5,9,10 - tetrahydro - 5,10 - diphenyl-, 2458^a.
 C₁₇H₁₅N₂ Cinnamonitrile, β - triphenylmethyl-amino-, 245^a.
 C₁₇H₁₅N₂O₂ Trimethylenimine, 2 - keto - 1 - p - nitrobenzyl - 3,3,4 - triphenyl-, 1425^a.
 C₁₇H₁₅N₂N₂O₁₀S₂ Chrysophenine, 2848^a.
 C₁₇H₁₅N₂O₂ Ac deriv., m. 140-50°, 1 compd. from p-phenylazophenol, 2646^a.
 C₁₇H₁₅O₂ Compd., m. 195°, from piperonal and Δ¹-3-pentenone, 1-p-anisyl-, 467^a.
 C₁₇H₁₅NO Δ¹-3-Pentadienol, 2-(2-naphthyliminoethyl) - 1,1 - diphenyl-(?), - HCl, 2327^a.
 C₁₇H₁₅NO₂ Benzoin, α-benzyl-, carbanilate, 273^a.
 C₁₇H₁₅N₂O₂ Ketone, 2 - keto - 1 - methyl - 3 - piperidyl 2 - phenyl - 4 - quinolyl, picrate, 657^a.
 C₁₇H₁₅Br₂N₂O Bibenzyl, p', p' - azoxy - α, α' - dibromo - α, α' - bis(N - methylanilino)-, 482^a.
 C₁₇H₁₅ClN₂ Quinoxaline, 1,7-dihydro-7-methyl-imino - 1,2,3-triphenyl-, methochloride, perchlorate, 644¹.
 C₁₇H₁₅LiN₂O₂ Addn. compd. of hydroquinol and 1,1' - diphenyl - 4,4' - bipyridinium diiodide, 2053^a.
 C₁₇H₁₅N₂O₂S Benzaniide, 0', 0''' - dithio-bis[N-methyl-, 2339^a.
 α - Toluaniide ar', ar''' - dithio-bis-, 816¹.
 C₁₇H₁₅N₂ Compd., m. 100°, from o, o' - hydrazo-bis[N - p - tolylbenzylamine], 482¹.
 Compd., m. 102-3°, from 1-acetyl-2-methyl-3-indolenitrile and α-tolunitrile, 505^a.
 C₁₇H₁₅N₂O₂ Benzil, bis(4-phenylsemicarbazone), 2680^a.
 C₁₇H₁₅N₂O₁₀ Ketone, 1 - methyl - 2 - piperidyl 4 - quinolyl, dipicrate, 656^a.
 C₁₇H₁₅O₂ 9,10 - Anthradol, 9,10 - dihydro-9,10-di - o - tolyl-, 2485^a.
 C₁₇H₁₅O₂ Acetophenone, α, α' - di - p - anisyl-α-phenyl-, 1559^a, 1859^a.
 C₁₇H₁₅CINO₂ 4 - (p - Dimethylaminostyryl)-7-hydroxy-2-(p - methoxyphenyl)benzopyrylium chloride, 1707^a.
 C₁₇H₁₅CuN₂O₂ Formamidine, N-hydroxy-N-(and N') - phenyl - N'-(and N) - p - tolyl-, Cu salt, 978^{1,2}.
 C₁₇H₁₅N₂O₂ Diethylamine, N-nitroso-β,β,β',β'-tetraphenyl-, 2822^a.
 C₁₇H₁₅N₂ Acetophenone, α, α' - (p, p' - bi-phenylene)bishydrazone, 3259¹.

- C₂₂H₂₇N₃O₂ Anisaldehyde, β , α' - (p , p' - biphenylene)bishydrazone, 3259¹.
- C₂₂H₂₇N₃O₂ Et ether, m. 218-22°, of compd. from p -phenylazophenol, 2646¹.
- C₂₂H₂₇N₃O₂ 4-Quinolincarbinol, α - (1-methyl-2 - pipicinyloxy), dipicrate, 658¹.
- C₂₂H₂₇O Compd., m. 176-7°, from benzaldehyde and 2-heptanone, 470¹.
- C₂₂H₂₇O Cyclohexanone, bis(ϵ - Ylenyl - Δ^4 - pentadienylidene), 2940¹.
- C₂₂H₂₇O₂ Benzopinacol, s - p , p' -dimethoxy-, 1858¹.
- Compd., m. 158°, from anisaldehyde and 2-butanone, 467¹.
- C₂₂H₂₇O₂ Glucoside, α -methyl-, tribenzoate, 250¹.
- C₂₂H₂₇N Diethylamine, β , β , β' , β' -tetraphenyl-, -HCl, 2822¹.
- C₂₂H₂₇N₂O Addn. compd. of 4-dimethylamino-4' - methoxycarbonyl and 1 - naphthol, 1255¹.
- C₂₂H₂₇N₂O Bulbocapnine, carbobenzoxy-, Me ether, 2055¹.
- C₂₂H₂₇N₂O Quinine-amine, N - phthalyl-, 2055¹.
- C₂₂H₂₇N₂O 3,4 - Pyrroledicarboxylic acid, 1-[p - (hydroxynaphthylazo)phenyl] - 2,5 - dimethyl-, di-Et ester, 279¹.
- C₂₂H₂₇ClN₂O₂, 2173¹.
- C₂₂H₂₇Ge Germanium tetra- p -tolyl, 2473¹.
- C₂₂H₂₇N₂ Benzylamine, o , o' -azobis[N -tolyl-, 482¹.
- C₂₂H₂₇N₂O Benzylamine, o , o' -azobis[N -tolyl-, 482¹.
- C₂₂H₂₇N₂O₂ See Chrysophenin.
- C₂₂H₂₇N₂O₂ Aniline, N , N' - (2,3-butylene)bis- (p - p' - sulfophenylazo-), and salts, 2936¹.
- C₂₂H₂₇N₂O Azoxybenzene, o , o' - bis(p - dimethylaminophenylazo-), 514¹.
- C₂₂H₂₇N₂O₂ 3,3' - Biazole, 4,5,6,7,4',5',6' - trihydro 7,7' - dimethyl-, dipicrate, 1263¹.
- C₂₂H₂₇O₂ 2,4 - Pentanedione, 3 - cinnamal-, dimer of, 2941¹.
- C₂₂H₂₇O₂ Carbitol, tri(4,3-cresyl)-, tri- or -acetate, 2486¹.
- C₂₂H₂₇N₂O₂ 5 - Pyrazolone, [diethyl 1 - phenyl-3 - methyl - 4 - (p - aminophenyl) - 2,5 - dimethylpyrrole - 3,4 - dicarboxylate-azol-], 279¹.
- C₂₂H₂₇BrN₂O₂ Addn. compd. of acetic acid and 1,1' - dibenzyl-, 4,4' - bipyridinium dibromide, 2053¹.
- C₂₂H₂₇N₂O₂ Dimigotic acid, 4 - p - anisyl - 1,2 - dihydro - 1,6 - dimethyl - 2 - (phenylcarbamylmethylene)-, di-Et ester, 2497¹.
- C₂₂H₂₇N₂O₂ Disulfidothiophosphate di - p - phenetide, diPh ester, 2325¹.
- C₂₂H₂₇N₂ Benzylamine, o , o' - hydroazobis[N -tolyl-, 482¹.
- C₂₂H₂₇N₂O₂ 3,4 - Pyrroledicarboxylic acid, 2,5 - dimethyl - 1' [p - (α - phenylcarbamylacetylazo)phenyl], di-Et ester 279¹.
- C₂₂H₂₇N₂O₂ Guaiacol, 5 - (1,2,3,4 - tetrahydro-6,7 - dimethoxy - 2,4 - dimethyl - 3 - vinyl-4 - vinyl-, picrate, 2670¹.
- C₂₂H₂₇N₂O₂ Capric acid, ϵ - amino - α - 4 - quinolylformyl-, Et ester, picrolonate, 669¹.
- C₂₂H₂₇O₂ d - Glucose, acetone, 6 - triphenylmethyl-, 2479¹.
- C₂₂H₂₇O₂ Addn. compd., m. 47.5°, of dimethyl oxalate and phenol, 1104¹.
- C₂₂H₂₇N₂O₂ Isatinrhodamine, 2197¹.
- C₂₂H₂₇CuN₂O₂, 2173¹.
- C₂₂H₂₇N₂O₂ Delydroeseretholemethine, dipicrate, 2140¹.
- C₂₂H₂₇N₂O₂ Salicin, tetraacetate, benzyl ether, 3088¹.
- C₂₂H₂₇N₂O₂ Lobelanidine, diacetyl-, acetate, 2281¹.
- C₂₂H₂₇N₂O₂ Pentadecylaldehyde, m -nitrobenzoylhydrazones, 3251¹.
- C₂₂H₂₇ Anthracene, 1,2,3,4,5,6,7,8-octahydro-(5-tetrahydro-naphthylbutyl)-, 1270¹.
- C₂₂H₂₇N₂O Pentadecylaldehyde, benzoylhydrazones, 3251¹.
- C₂₂H₂₇N₂O₂ 3 - Pyrroledicarboxylic acid, 5,5' - (carboxydimethyl - 3 - pyrrolylmethylene)-bis(2,4 - dimethyl-, tri-Et ester, 741¹.
- C₂₂H₂₇N₂O₂ Cyclohexanecetic acid, α -hydroxy-, quinine salt, 982¹.
- C₂₂H₂₇O₂ Maltose, octaacetyl-, 2035¹.
- Octaacetate of disaccharide from amylose, 975¹.
- C₂₂H₂₇N₂O₂ Crochaeline, 2550¹.
- C₂₂H₂₇N₂O₂ Maltoside, hepta- α -tyl-ethyl-, 2035¹.
- C₂₂H₂₇N₂O₂ Pentadecylaldehyde, benzylphenylhydrazones, 3251¹.
- C₂₂H₂₇O₂ Reductodehydrocholic acid, carbethoxy-, Me ester, 640¹.
- C₂₂H₂₇O₂ Elemolic acid, Me ester, 269¹.
- C₂₂H₂₇O₂ Cholic acid, carbethoxy-, Me ester, 640¹.
- C₂₂H₂₇O₂ Myristic anhydride, 3081¹.
- C₂₂H₂₇N₂O₂ Phthalimide, N , N' - [4,4'-methylenebis(3 (and 2) - naphthyl)]-bis-, 3267¹.
- C₂₂H₂₇BrClNO₂ Naphtho- m -tolide, 5-bromo-5' - chloro - 6' - hydroxy-, 2 - naphthoate, 1562¹.
- , 5' - chloro - 6' - hydroxy-, 5 - bromo - 1 - naphthoate, 1562¹.
- C₂₂H₂₇N₂O₂ 1,4 - Benzopyran, 4 - phenacylidene-2-phenyl-, picrate, 288¹.
- 2,6 - Diphenyl - 4 - salicylpyrylium picrate, 288¹.
- C₂₂H₂₇ Chrysouluorene, 11 β (p - phenylphenyl)-, 2045¹.
- C₂₂H₂₇ClNO₂ Naphtho- m -tolide, 5' - chloro-6' - hydroxy-, naphthoate, 1562¹.
- C₂₂H₂₇ClN₂O Compd. from 6 - methyl - 3,4-phenoxazinedione and N^3 - phenyl - 1,2-naphthylenediamine, 1283¹.
- C₂₂H₂₇Cl₂ 1,4 - Benzopyran, 2,4 - di - 1 - naphthyl-, 287¹.
- C₂₂H₂₇O₂ Naphtholcoumarin, 2197¹.
- C₂₂H₂₇O₂ 2,2' - Bi - 1(2) - benzofuranone, 2 - methyl - 2,2' - diphenyl-, 2044¹.
- C₂₂H₂₇O₂ Chalcone, 4,4' - dihydroxy-, dibenzoate, 1414¹.
- C₂₂H₂₇Br Methane, bromo - 1 - naphthylphenyl- (p - phenylphenyl)-, 2745¹.
- C₂₂H₂₇BrN₂O₂ 4 - (p - Hydroxyphenyl) - 1 - (m -naphthylphenyl) - 2,6 - diphenylpyridinium bromide, 989¹.
- C₂₂H₂₇BrNO₂ 2,4,6 - Tri(p - hydroxyphenyl)-1-phenylpyridinium bromide, 989¹.
- C₂₂H₂₇N₂O Pyridine, 1 - (aminophenyl) - 1,4 - dihydro - 4 - (p - keto - p - phenylidene)-2,6 - diphenyl-, and salts, 989¹.
- C₂₂H₂₇N₂O₂ Benzohydrylamine, α - 1 - naphthyl- N -(m -nitrophenyl)-, 2044¹.
- 6,7-Indoloquinoline, 7,8-diphenyl-, acetate, 895¹.
- C₂₂H₂₇N₂O₂ Benzohydrylamine, α -1-naphthyl-, picrate, 2044¹.

$C_{11}H_{11}N_3S$ Carbanilide, *p, p'*-bis(5-methyl-1-benzothiazolyl)thio-, 284⁴.

$C_{11}H_{11}O_2$ Acetic acid, α, α -di-1-naphthylbenzyl ester, 1704⁵.

2-Chromanol, 2,4-di-1-naphthyl-, 287⁶.

$C_{11}H_{11}O_2S_2$ Butyric acid, α -benzoyl- γ -hydroxy- β -keto - α, γ -triphenyldithio-, γ -thiolactone, 1257⁷.

$C_{11}H_{11}ClN_2O$ 1-(*p*-Aminophenyl)-2-(*p*-hydroxyphenyl)-4,6-diphenylpyridinium chloride, -HCl, 989⁸.

$C_{11}H_{11}CuN_2O_4$, 2173⁷.

$C_{11}H_{11}NO$ Pyrrole, 1-methyl-2,3,4,5-tetra-phenyl-, 2343⁴.

$C_{11}H_{11}N_2O_2S$ 6,7- β -Indoloquinoline, 7,8-diphenyl-, methosulfate, 2956⁹.

$C_{11}H_{11}NO$ Crotonophenone, β -triphenylmethyl-amino-, 245⁴.

$C_{11}H_{11}ClN_2O$ as-Triazine, 4-*p*-anisyl-3-(*p*-chlorophenyl)-2,3,4,5-tetrahydro-6-phenyl-2-*o*-tolyl-, 478¹.

$C_{11}H_{11}N_2O$ Crotonanilide, β -triphenylmethyl-amino-, 245⁴.

$C_{11}H_{11}N_2O_2$ Hydrazine, α, β -bis(diphenylacetyl)- α -methyl-, 1254⁴.

1,2-Propanediamine, *N, N'*-dibenzoyl-*N, N'*-diphenyl-, 492².

$C_{11}H_{11}N_2O_2S$ 1(of 2)-Propanesulfonic acid, 3-(2-naphthylimino)-1-phenyl-, 2-naphthylamine salt, 2328².

$C_{11}H_{11}O_2$ Hydrocinamic acid, α -phenyl- α -*p*-tolyl-, benzyl ester, 645⁴.

$C_{11}H_{11}N_2O$ as-Triazine, 4-*p*-anisyl-2,3,4,5-tetrahydro-3,6-diphenyl-2-*o*-tolyl-, 478².

$C_{11}H_{11}N_2O_2$ Adim. compd. of dimethylketene and phenyl isocyanate, 2189¹.

$C_{11}H_{11}N_2O_2$ Ketone, δ -(*N*-ethylbenzamido-butyl) 4-quinolyl, picrate, 657¹.

$C_{11}H_{11}N_2O_4$ Ecgonine, benzoate, *p*-nitrobenzyl ester, picrate, 2343⁷.

$C_{11}H_{11}$ Propane, 2,2-dibenzyl-1,3-diphenyl-, 1138⁷.

$C_{11}H_{11}As_2N_2O_4$ Carbanilide, *p, p'*-bis(4-*ar*-sono-*o*-tolylcarbamyl)-, 1562².

$C_{11}H_{11}ClN_2O_2$ Compd., m. 123-4⁹, from *N*-phenacyl-*p*-anisidine *o*-tolylhydrazone and *p*-chlorobenzaldehyde, 478⁴.

$C_{11}H_{11}N_2O_4$ Ecgonine, benzoate, benzyl ester, picrate, 2343⁴.

Pseudoecgonine, benzoylbenzyl-, picrate, 2343⁴.

$C_{11}H_{11}N_2O_2$ Ecgonine, benzoate, *o*-hydroxybenzyl ester, picrate, 2343⁷; salicylate, benzyl ester, picrate, 2343⁷.

$C_{11}H_{11}N_2O_4$ Ketone, 6-methoxy-4-quinolyl- α -methylaminoamyl-, dipicrate, 656¹.

$C_{11}H_{11}O_2$ Glucoside, dimethyl-, tribenzoate, 250⁷.

$C_{11}H_{11}BrN_2O_2S$ 1,2,4-Triphenyl-1,2,3,5-tetrazolium *d*-bromocamphorsulfonate, 2028⁴.

$C_{11}H_{11}N_2O_2S$ 1,2,4-Triphenyl-1,2,3,5-tetrazolium *d*-camphorsulfonate, 2028⁴.

$C_{11}H_{11}NO_2$ Lobeline, benzoyl-, and -HCl,

$C_{11}H_{11}N_2O_2$ Compd., m. 135⁹, from di-Et 1,2-dihydro-1,4,6-trimethyl-2-methylenedimicotinate and 2PhNCO, 2497⁹.

$C_{11}H_{11}N_2O_2$ Coumarinrhodamine, 2197².

$C_{11}H_{11}N_2O_2$ 2-Idolol, θ -(γ -dimethylamino-propyl)-6-ethoxy-2,3-dihydro-1-methyl-, diquaternary picrate, 1140⁵.

$C_{11}H_{11}O_2$ Gluc tetramethylphenyl-methyl-, 2

$C_{11}H_{11}CrN_2O_4$, 6¹

$C_{11}H_{11}N_2O_2$ 4-Cyano-2-nitrophenylhydrazone of ketone from desoxybutanic acid, 253².

$C_{11}H_{11}N_2O_2$ Quininetrimethylammonium mono-picrate, 2055⁷.

$C_{11}H_{11}Br_2Mo_2N_2O_2$, 2386⁵.

$C_{11}H_{11}O_2$ Tri-Me ester of acid from digitonin, 1861⁹.

$C_{11}H_{11}O$ Hederagenone, 3487².

$C_{11}H_{11}O_2$ Tetra-Me ester, m. 125⁹, of tetra-basic acid from digitonin, 1861⁹.

$C_{11}H_{11}N_2S_2$ Pentasulfide, dibenzyl, triperidine compd., 464².

$C_{11}H_{11}O$ Ketone, m. 110-1⁹, from stigmasterol-dicarboxylic acid, 473⁹.

$C_{11}H_{11}O_2$ Acid from Rhenish brown coal, 1768².

$C_{11}H_{11}O_4$ 7,9,16,18-Benzonaphthonaphthacene-tetrone, 631¹.

$C_{11}H_{11}Cl_2O_2$ Anthraquinone, 1,1'-ethylenebis-[4-chloro-(?)], 1571⁴.

$C_{11}H_{11}O_2$ Succinic anhydride, difluoride, 3089².

$C_{11}H_{11}O_4$ 7,14-Naphthodianthrenedione, 3,10-dimethoxy-(?), 3270¹.

$C_{11}H_{11}O$ Anthraquinone, 2,2'-ethylenebis-(?), 1571¹.

$C_{11}H_{11}O_2S$ Thioindigo white, dibenzoate, 504⁵.

$C_{11}H_{11}O_2S$ Thioindigo white, *S*-monoxide, dibenzoate, 504².

$C_{11}H_{11}O_2$ Isophthalic acid, 4,6-(di-1-naphthoyl)-, 62⁹.

Terephthalic acid, 5-bis(1-naphthoyl)-, 631¹.

$C_{11}H_{11}O_2S$ Thioindigo white, *S*-dioxide, dibenzoate, 504⁷.

$C_{11}H_{11}NO_2$ 1,1'-Bi-2(1)- α -naphthofuranone, 1-anilino-, 2047².

$C_{11}H_{11}N_2O_2S$ Dye from 1-(3-hydroxy-4-keto-1(4)-naphthylidene-2(1)-thionaphthenone and $H_2NC_6H_4N_2Ph$, 2493⁴.

$C_{11}H_{11}O$, $\Delta^{10,10'}$ -Bianthrone, 3,6'-dimethoxy-, 3269⁹.

$C_{11}H_{11}O_2$ Anthraquinone, 1,4,5,8-tetrahydroxy-2,6-dimethyl-, dibenzoate, 276⁷.

$C_{11}H_{11}Br_2Sb$ Stibine, tri-1-naphthyl-, dibromide, 1704⁴.

$C_{11}H_{11}Cl_2Sb$ Stibine, tri-1-naphthyl-, dichloride, 1704⁴.

$C_{11}H_{11}OSb$ Stibine oxide, tri-1-naphthyl-, 1704⁴.

$C_{11}H_{11}Sb$ Stibine, tri-1-naphthyl-, 1704⁴.

$C_{11}H_{11}$ 2,1-Indenoidene, 5,10-ditolyl-, 2488⁷.

$C_{11}H_{11}N_2O_2$ Phenanthrenequinone, 2,7-bis(*p*-methylbenzalamino)-, 2491⁴.

$C_{11}H_{11}N_2O_2$ Phenanthrenequinone, 2,7-bis(amisalamino)-, 2491⁴.

$C_{11}H_{11}$ Fluorindine, 2-amino-3-anilino-5-phenyl-, 1283⁴.

$C_{11}H_{11}O$ Benzil, 2,2'-bistoluy-, 2488⁷.

2,2'-Bi-1(2)-benzofuranone, dimethyl-2-*p*-diphenyl-, 277², 2043⁷, 2044⁷.

$C_{11}H_{11}O$ 1(2)-Benzofuranone, 2,2'-dioxybis[4-methyl-2-phenyl-, 2044⁷.

$C_{11}H_{11}Cl$ Methane, chloro-1-naphthyl-*p*-phenyl-phenyl-*p*-tolyl-, 2045².

$C_{11}H_{11}ClN_2O_2P$ Compd., m. 175-8⁹, from 6,7-dihydropyrazinoacrid-1(2)-one and PCl_5 , 295⁹.

$C_{11}H_{11}ClO$ Methane, (3-benzyloxy-2-naphthyl)-chlorodiphenyl-, 2945⁵.

$C_{11}H_{11}N_2O_2$ 1-Naphthalenesulfonic acid, 8-(2,4-dibenzamidoanilino)-, 2862².

- C₂₀H₁₃N₃O₆ *o*-Toluic acid, 4- (4 - hydroxy - 3-phenylazophenyl)-, α , α' - (p - keto - p-*pk* mylidene)-, oxime, diacetate, 273¹.
- C₂₀H₁₃N₃O₆ Methyl, (3 - benzyloxy - 2 - naphthyl)-diphenyl-, 2945².
- C₂₀H₁₃N₃O₆ 2,1 - Indenoindene, 5,10 - dihydro-5,10 - ditolyl-, 2488².
- C₂₀H₁₃N₃O₆ Bibenzyl, α , α' - bis(*N*-acetyl, *o*-salino) - p, p' - azoxy - α , α' - dibromo-, 48².
- C₂₀H₁₃N₃O₆ Benzohydrylamine, p - methyl α -1-naphthyl-*N*-(*m*-nitrophenyl)-, 2045¹.
- C₂₀H₁₃N₃O₆ Salicylanilide, trithiobis-, diacetate, 816¹.
- C₂₀H₁₃N₃O₆ Stilbene, α , α' -bis(*N*-acetylanilino)-p, p'-azoxy-, 482¹.
- C₂₀H₁₃N₃O₆ Ether, methyl α -1-naphthyl-p-phenyl-benzohydryl-, 2045¹.
- Methane, (3 - benzyloxy - 2 - naphthyl)-diphenyl-, 2945².
- C₂₀H₁₃N₃O₆ Carbinol, (3 - benzyloxy - 2 - naphthyl)-diphenyl-, 2945².
- 2,1 - Indenoindene, 5,10-dianisyl-5,10-dihydro-, 2488².
- C₂₀H₁₃N₃O₆ Atromentin, pentaacetyl-, 639⁴.
- C₂₀H₁₃N₃O₆ Compd. from 2'-hydroxy-2-methoxy - 4 - methylidibenzamide, NH₃, and AgNO₃, 1416².
- C₂₀H₁₃N₃O₆ 2,1 - Indenoindene, 4,5,9,10 - tetrahydro-5,10-ditolyl-, 2488².
- C₂₀H₁₃N₃O₆ 2,4 - Naphthalenediol, 2,3 - bis(*N*-acetylanilino)-, diacetate, 2821¹.
- C₂₀H₁₃N₃O₆ Cinnamaldehyde, α , α' - (p, p' - biphenylene)bispyrazone, 3259¹.
- C₂₀H₁₃N₃O₆ 2,1 - Indenoindene, 5,10 - dianisyl-4,5,9,10-tetrahydro-, 2488².
- 2,1 - Indenoindene - 5,10 - diol, 4,5,9,10-tetrahydro - 5,10 - di - *m*-tolyl-, 2488².
- C₂₀H₁₃N₃O₆ Isophthalic acid, 4,6-bis(tetrahydro-2-naphthyl)-, 63¹, 1275².
- Terephthalic acid, 2,5 - bis(5,6,7,8-tetrahydro-2-naphthyl)-(?), 1275².
- C₂₀H₁₃N₃O₆ 1385¹.
- C₂₀H₁₃N₃O₆ Addn. compd. of hydroquinol and 1,1' - dibenzyl - 4,4' - bipyridinium dibromide, 2053².
- C₂₀H₁₃N₃O₆ Addn. compd. of hydroquinol and 1,1' - dibenzyl - 4,4' - bipyridinium dichloride, 2053².
- C₂₀H₁₃N₃O₆ + 2H₂O, 619².
- C₂₀H₁₃N₃O₆ Addn. compd. of hydroquinol with 1,1' - dibenzyl - 4,4' - bipyridinium diiodide, 2053².
- C₂₀H₁₃N₃O₆ Diphenimidic acid, *N*, *N'* - diphenyl-, di-Et ester, 1703¹.
- C₂₀H₁₃N₃O₆ 9,10 - Anthradic, 9,10 - dihydro-9,10-dixyl-, 2488².
- Ethylene oxide, α -methyl- α , β -diphenyl-, dimer, 491¹.
- C₂₀H₁₃N₃O₆ Benzene-nitrobenzene complex, 1980¹.
- C₂₀H₁₃N₃O₆ as Triazine, 3,4¹ di - p - anisyl-2,3,4,6 - tetrahydro - 6 - phenyl-2 - *o*-tolyl-, 478².
- C₂₀H₁₃N₃O₆ 1 - Naphthol, 2,4 - bis(5 - bromo-2-carboxylazo)-, 641¹.
- C₂₀H₁₃N₃O₆ ClC₆H₄N₃O₆, 2173¹.
- C₂₀H₁₃N₃O₆ Ecgonine, benzoate, phenethyl ester, picrate, 2343¹.
- C₂₀H₁₃N₃O₆ Ecgonine, cresotate, benzyl ester, picrate, 2343¹.
- C₂₀H₁₃N₃O₆ Compd., m. 136°, from decalin and pyromellitic acid, 1275².
- C₂₀H₁₃N₃O₆ Compd., m. 152° from *N*-phenacyl-p-anisidine *o*-tolylhydrazone and anisaldehyde, 478².
- C₂₀H₁₃N₃O₆ Stilbene, p, p' - azoxy, α , α' - bis(*N*-methylamino)-, di-MeHSO₄ salt, 482¹.
- C₂₀H₁₃N₃O₆ Acid from (5,6,7,8 - tetrahydro-2-naphthylmethyl)malonic acid, mono-*K* salt, 1273¹.
- C₂₀H₁₃N₃O₆ 3,4 - Pyrroledicarboxylic acid, 2,5-dimethyl - 1 - [p - (p-phenylcarbamyl-acetonylazo)phenyl]-, di-Et ester, 279¹.
- C₂₀H₁₃N₃O₆ See *Picroloxin*.
- C₂₀H₁₃N₃O₆ 3071¹.
- C₂₀H₁₃N₃O₆ Thymol, 2,6 - bis(5 - bromo-2-carboxylazo)-, 641¹.
- C₂₀H₁₃N₃O₆ Chrysarobin, 2672², 2724².
- C₂₀H₁₃N₃O₆ Pyrodesoxybilanic acid, p-chlorobenzal-, 252².
- C₂₀H₁₃N₃O₆ Pyrodesoxybilanic acid, p-nitrobenzal-, 252².
- C₂₀H₁₃N₃O₆ Anisal deriv. of ketone from desoxy-bilanic acid, 253².
- C₂₀H₁₃N₃O₆ Pyrodesoxybilanic acid, benzal-, 252².
- C₂₀H₁₃N₃O₆ Glucosidoglucosidoglucose, osazone, 975².
- C₂₀H₁₃N₃O₆ Resorcinolstearin, 217².
- C₂₀H₁₃N₃O₆ Loriglossin, 1442¹.
- C₂₀H₁₃N₃O₆ Malonic acid, benzal-, dimethyl ester, 1416².
- C₂₀H₁₃N₃O₆ Benzohydrol, α - (α -aminobenzyl)-, camphorsulfonate, 1138².
- C₂₀H₁₃N₃O₆ 3 - Pyrroledicarboxylic acid, (hydroxymethyl)dimethyl-, Et ester, trimer, 2336².
- C₂₀H₁₃N₃O₆ Malolic acid, 841¹, 842¹.
- C₂₀H₁₃N₃O₆ Δ^1 - 1,3 - Cyclohexenedicarboxylic acid, 4 - keto - 2,6 - dimethyl-, dimethyl ester, 247¹.
- Hederagenolic acid, 3487².
- C₂₀H₁₃N₃O₆ Squalene, 2420⁴.
- C₂₀H₁₃N₃O₆ β -Amyrin, 2942².
- Stigmasterol, 473².
- C₂₀H₁₃N₃O₆ Glutaric acid, α , γ -diacetyl- β -methyl, dimethyl ester, 216².
- C₂₀H₁₃N₃O₆ Stigmasterone, 473².
- C₂₀H₁₃N₃O₆ Acid, m. 229-30°, from stigmasterol, 473².
- C₂₀H₁₃N₃O₆ Stigmasterone, oxime, 473².
- C₂₀H₁₃N₃O₆ Stigmasterane, 474¹.
- C₂₀H₁₃N₃O₆ Stigmasterol, 473².
- C₂₀H₁₃N₃O₆ 2790¹.
- C₂₀H₁₃N₃O₆ Lanoceric acid, 741¹.
- C₂₀H₁₃N₃O₆ Methanestannic acid, hexabutyrate, and hexaisobutyrate, 465¹.
- C₂₀H₁₃N₃O₆ Compd., m. 62°, from the cotton plant, 2227¹.
- Triacotane, 841².
- C₂₀H₁₃N₃O₆ Myricyl alcohol, 1768¹, 3396¹.
- C₂₀H₁₃N₃O₆ 6,13 - Diindolopyridinedione, 12-benzoyl-7-phenyl-, 260².
- 6(12) - Diindolopyridinone, 13 - hydroxy - 7-phenyl-, benzoate(?), 280².
- C₂₀H₁₃N₃O₆ α , β' - Dibenzoxanthene, 14 - (1 - naphthyl)-, 2944².
- C₂₀H₁₃N₃O₆ Oxazole, [p - (hydroxynaphthylazo)-phenyl]diphenyl-, 2667².
- C₂₀H₁₃N₃O₆ Imidazole, 2 - [m - (hydroxynaphthylazo)phenyl] - 4,5 - diphenyl-, 2494².
- C₂₀H₁₃N₃O₆ Naphthalene, 1,2,5 - tribenzamido-, 2661².
- C₂₀H₁₃N₃O₆ Pyridine, 1 - [m (and p) - acetamidophenyl] - 1,4 - dihydro - 4 - (p - keto - p-phenylidene) - 2,6 - diphenyl-, 980².

- C₂₁H₁₇N₃O₂** Indone, 2,2' - methylenebis[3-phenylhydrazino-, 3486.
C₂₁H₁₇N₃ Diphenylamine, *N*-triphenylmethyl-, 2476.
C₂₁H₁₇N₃O₂ Quinoline, 4 - phenylmethoxy - 2 - (o-phenylmethoxystyryl)-, 1279.
C₂₁H₁₇O₂ Ether, methyl *p* - methyl - α - 1 - naphthyl - *p*' - phenylbenzohydryl, 2045.
C₂₁H₁₇O₂ Methane, (2,5 - dimethoxyphenyl) - (1 - naphthyl)diphenyl-, 2947.
C₂₁H₁₇O₂ Addn. compd., m. 98-100°, of α -1-naphthyl - *p* - phenylbenzohydrol with acetic acid, 2045.
C₂₁H₁₇O₂ Compd., m. 237-9°, from piperonal and 2 - heptanone, 470.
C₂₁H₁₇N₃O₁₁ Caproic acid, ϵ - benzamido - α - (6-methoxy - 4 - quinolylformyl)-, Et ester, picrate, 656.
C₂₁H₁₇N₃O₄ Malonanilide, α , α - bis(β - phenoxy-ethyl)-, 61.
C₂₁H₁₇O₂ Addn. compd., m. 88-90°, of 1,5-di-*p*-anisyl-3-pentadienone and resorcinol, 1253.
C₂₁H₁₇N₃O₄ + 2.5H₂O *d*-Gluconic acid, triphenylmethyl-, phenylhydrazide, 2479.
C₂₁H₁₇N₃O₄ as - Triazine, 4 - *p*-anisyl - 3 - (*p*-dimethylaminophenyl) - 2,3,4,5 - tetrahydro - 6 - phenyl - 2 - *o* - tolyl-, 478.
C₂₁H₁₇N₃O₁₂ Egonine, tropate, benzyl ester, picrate, 2343.
C₂₁H₁₇N₃O₁₁ Ketone, δ - methylaminobutyl 3-pyridyl, dipicolonate, 657.
C₂₁H₁₇N₃O₂ Compd., m. 118°, from *N* - phenacyl-*p*-anisidine, *o*-tolylhydrazine and *p*-dimethylaminobenzaldehyde, 478.
C₂₁H₁₇N₃O₂S 2 - Benzimidazolemethane sulfonic acid, α - ethyl-, strychnine salt, 38.
C₂₁H₁₇N₃O₂ Dimethylidiphenylammonium iodide, CH₃I addn. compd., 1403.
C₂₁H₁₇N₃O₂S 1 - Propanesulfonic acid, 1 - phenylcarbamyl-, strychnine salt, 38.
C₂₁H₁₇N₃O₂ 3,4(α , β) - Quinocholanic acid, 7,13-diketo-, and -HCl, 252.
C₂₁H₁₇O₂ α - Isgostrophanthidic acid, Me ester, benzoate, 1142.
C₂₁H₁₇N₃O₂ 3,4(α , β) - Quinocholanic acid, 7-keto-, 252.
C₂₁H₁₇N₃O₂ 3,4(α , β) - Quinocholanic acid, 7,13-diketo-, dioxime, 252.
C₂₁H₁₇O₂ Pyrodesoxybiliaric acid, anisal-, 252.
C₂₁H₁₇N₃O₂S 2 - (Carboxymethyl)isoquinolinium *d* - camphorsulfonate, bornyl ester, 2028.
C₂₁H₁₇N₃O₂S 2 - (Carboxymethyl)isoquinolinium *d* - camphorsulfonate, menthyl ester, 2028.
C₂₁H₁₇N₃O₁₁ Bis(diacetonegalactos)amine, Bz deriv., 1560.
C₂₁H₁₇ClO₂S Hederagenin chloride, sulfite, 2056.
C₂₁H₁₇O₂ Hederagenic acid, 3487.
C₂₁H₁₇O₂ Cholic acid, Me ester, triacetate, 640.
C₂₁H₁₇N₃O₂S Hederagenin amide, sulfite, 2056.
C₂₁H₁₇O₂ Oleanolic acid, 73°, 74°. Ursolic acid, 73°, 74°.
C₂₁H₁₇O₂ Hederagenin, 2056°, 2673°, 3486.
C₂₁H₁₇N₃O₂ Hederagenin amide, 2056.
C₂₁H₁₇N₃O₂ Δ^4 - 1,3 - Cyclohexenedicarboxylic acid, 4 - keto - 2,6 - dimethyl-, dimethyl ester, semicarbazone, 2471.
C₂₁H₁₇Br₂ClCoN₂O₂S, 67.
C₂₁H₁₇N₃O₂ Glutaric acid, α , γ - diacetyl - β - methyl dimethyl ester, semicarbazone, 246.
C₂₁H₁₇O₂ 1,6-Hentriacontanone, 1692.
C₂₁H₁₇O₂ Hentriacontane, 1692.
C₂₁H₁₇O₂ 6,6' - Biacetracoumarin, 320.
C₂₁H₁₇O₂ 7,14 - Naphthodianthredione, 3,10-dihydroxy-, diacetate, 3969.
C₂₁H₁₇Br₂O₂ Phenolresorcinolphthalein, tetra-bromo-, 2197.
C₂₁H₁₇K₂O₂ Phenolresorcinolphthalein, di-K deriv., 2197.
C₂₁H₁₇As₂Br₂N₂O₁₁ Fluorescein, 4,5 - arsonophenylazo-) - 2,7 - dibromo-, 264.
C₂₁H₁₇As₂Cl₂N₂O₁₀ Phenolphthalein, 3',3''-bis-(*p*-arsonophenylazo) - 3,4,5,6 - tetrachloro-, 2647.
C₂₁H₁₇N₂ 1,2,3,4 - Dibenzofluorindine, 9-phenyl-, 1283.
C₂₁H₁₇O₂ $\Delta^{10,10'}$ - Bianthrone, 3,6' - dihydroxy-, diacetate, 3269.
C₂₁H₁₇O₂ Resorcinolfluorescein, 2197.
C₂₁H₁₇As₂N₂O₁₁ Fluorescein, 2,7 - bis(*p* - arsonophenylazo)-, 2647.
C₂₁H₁₇Cu₂O₂ Δ^2 - 1,4 - Butenedione, 2 - hydroxy-1,4 - diphenyl-, Cu salt, 2691.
C₂₁H₁₇N₂O₂ Phenanthrenequinone, 2,7 - bis-(cinnamalmino)-, 2491.
C₂₁H₁₇O₂ α , α' - Dibenzofluorene, 13 - (3 - methoxy - 2 - naphthyl)-, 2045.
C₂₁H₁₇O₂ Isophthalic acid, 4,6 - di-1-naphthyl-, di-Me ester, 62.
 Phenolresorcinolphthalein, 2197.
C₂₁H₁₇N₂ Quinoxaline, 1,7 - dihydro - 1,2,3 - triphenyl - 7 - phenylimino-, -HCl, 643.
C₂₁H₁₇N₂O₂ Phthalimidine, 3,3-bis(4-hydroxy-2-phenylazophenyl)-, 2732.
C₂₁H₁₇As₂N₂O₁₀ Phenolphthalein, 3', 3'' - bis(*p*-arsonophenylazo)-, 2647.
C₂₁H₁₇O₂ Carbinol, (3 - methoxy - 2 - naphthyl)-di-1 - naphthyl-, 2945.
 Truxone, dimethyldiphenyl-, 2209.
C₂₁H₁₇O₂ Benzoic anhydride, *p* - hydroxy-, α '-triphenylmethoxy-, 2479.
C₂₁H₁₇N₂O₂ Phthalimidine, 3 - (*p* - hydroxyphenyl) - 3 - (4 - hydroxy - 2 - phenylazophenyl)-, tri-Ac deriv., 2732.
C₂₁H₁₇ 2,1 - Indenoindene, 5,10 - di - (3,4-xylyl)-, 2488.
C₂₁H₁₇N₂O₂ 3 - Oxazolidinecarbamate, *N* - diphenylacetyl - 2,5 - diketo - 4,4 - di-phenyl - (?), Et ester, 1424.
 1,3,4,2 - Oxidiazine - 4 - carboxylic acid, 3-diphenylacetyl - 5,6 - dihydro - 2,6 - diketo - 5,5 - diphenyl-(?), Et ester, 1424.
C₂₁H₁₇N₂O₂ Imidazole, 4 - (aminomethyl)-tetrahydro - 2 - imino-, tetra-Bz deriv., 2052.
C₂₁H₁₇N₂O₂ Addn. compd. of dimethylketene and phenyl isocyanate, 2189.
C₂₁H₁₇O₂ Luteodypnopicacolin, 1859.
 Photodypnopicacolin, 1859.
C₂₁H₁₇O₂ Purofuran, 4,6-dimethyl-1,1,3,3-tetra-phenyl-, 502.
 2,1 - Indenoindene, 5,10 - diphenyl-, 2488.
C₂₁H₁₇O₂ 2,2' - Bi - 1(2) - benzofuranone, 4,6,4',6'-tetramethyl - 2,2' - diphenyl-, 2041.
C₂₁H₁₇O₂ Benzil, 2,2' - bisethoxybenzoyl-, 2488.
 2,2' - Bi - 1(2) - benzofuranone, 2,2' - di-anisyl - 4,4' - dimethyl-, 2041.
 —, 5,5' - dimethoxy - 4,4' - dimethyl - 2,2' - diphenyl-, 2041.

- $C_{10}H_{11}NO_2$ α, α' - *p* - Xylenol, amino-, α, α' - tetraphenyl-, 490.
 $C_{12}H_{13}NO_2$ Oxazolidine, 3 - benzoyl - 2 - dibenzoylamino - 2 - *N* - methylbenzamido-, 2052.
 $C_{12}H_{13}BaNO_2 + 3H_2O$ Dicresotamide, Ba deriv., 51^{1,2}.
 $C_{12}H_{13}CaNO_2$ Dicresotamide, Ca deriv., 51^{1,2}.
 $C_{12}H_{13}CuNO_2$ Dicresotamide, Cu deriv., 51^{1,2}.
 $C_{12}H_{13}HgNO_2 + 3H_2O$ Dicresotamide, Hg deriv., 51^{1,2}.
 $C_{12}H_{13}N_2O_2$ α, α' - Bisatrazine, *N, N'* - bis(*p*-carboxyphenyl) - α, α' - diphenyl-, di-Et ester, 471.
 $C_{12}H_{13}N_2O_2S$ Benzidine, naphthalenesulfonate, 650¹.
 $C_{12}H_{13}SrNO_2$ Dicresotamide, Sr deriv., 51^{1,2}.
 $C_{12}H_{13}O_2$ 2,1-Indenoidine, 5,10-dihydro-5,10-diphenyl-, 2488^{1,2}.
 $C_{12}H_{13}CuN_2O_2$ 2,1-Indenoidine, 5,10-dihydro-5,10-diphenyl-, 2488^{1,2}.
 $C_{12}H_{13}N_2O_2$ 1,3,4 - Triazole, 2,2' - dithiobis[5-*o*-toluino-1-*o*-tolyl]-, 2495¹.
 $C_{12}H_{13}O_2$ 2,1-Indenoidine, 4,5,9,10-tetrahydro-5,10-diphenyl-, 2488^{1,2}.
 $C_{12}H_{13}O_2$ 2,1-Indenoidine - 5,10 - diol, 4,5,9,10-tetrahydro-5,10 - di - (3,4 - xylyl)-, 2488^{1,2}.
 $C_{12}H_{13}O_2$ 4,4' - Bi - *o* - cresol, 6,6' - diethyl-, dibenzoate, 270¹.
 $C_{12}H_{13}O_2$ 2,1-Indenoidine - 5,10 - diol, 4,5,9,10-tetrahydro - 5,10 - diphenyl-, 2488^{1,2}.
 $C_{12}H_{13}N_2O_2$ Caproic acid, α - *N* - methylbenzamido - α - 4 - quinolylformyl-, Et ester, picrate, 650¹.
 $C_{12}H_{13}N_2O_2S$ Quinine-amine, *N* - benzene-sulfonyl-, picrate, 2055¹.
 $C_{12}H_{13}O_2$ Ethylene oxide, α - ethyl - α, β - di-, dimer, 491¹.
 $C_{12}H_{13}O_2$ Quinoxaline-amine, dipicrate, 2055¹.
 $C_{12}H_{13}O_2$ Butane, 2,2,3,3-tetrabenzyl-, 1138¹.
 $C_{12}H_{13}O_2$ Glucoside, methyltriphenylmethyl-, triacetate, 250¹.
 $C_{12}H_{13}N_2O_2$ Cuscohygrine, dihydro-, Br deriv., picrate, 1282¹.
 $C_{12}H_{13}NO_2$ 3,4(α, β) - Quinocholanic acid, γ -carboxy-7,13-diketo-, 252¹.
 $C_{12}H_{13}NO_2$ Δ^1 - 3 - Heptenol, acid phthalate, morphine salt, 2331¹.
 $C_{12}H_{13}NO_2$ 3,4(α, β) - Quinocholanic acid, γ -carboxy - 7,13^{1,2} - diketo-, monooxime, 252¹.
 $C_{12}H_{13}O_2$ Amygdalinic acid, lactone, hexaacetate, 270¹.
 $C_{12}H_{13}NO_2$ 3,4(α, β) - Quinocholanic acid, 7,13-diketo-, Me ester, 252¹.
 $C_{12}H_{13}NO_2$ 3,4(α, β) - Quinocholanic acid, γ -carboxy-7-keto-, 252¹.
 $C_{12}H_{13}O_2$ α - Isotrophanthic acid, di-Me ester, benzoate, 1148¹.
 $C_{12}H_{13}NO_2$ Reductodehydrocholic acid, β -nitrobenzoyl-, Me ester, 648¹.
 $C_{12}H_{13}NO_2$ Pyraconitine, deriv., 201^{1,2,3}.
 $C_{12}H_{13}NO_2$ Pyraconitine, and deriv., 201^{1,2,3}.
 $C_{12}H_{13}NO_2$ Cholic acid, 3 - *p* - nitrobenzoyl-, Me ester, 640¹.
 $C_{12}H_{13}NO_2$ Japbenzagenine, 201^{1,2}.
 $C_{12}H_{13}NO_2$ Hederagenic acid, Me ester, 2057¹.
 $C_{12}H_{13}NO_2$ Hederagenic acid, Me ester, 2057¹.
 $C_{12}H_{13}NO_2$ Hederagenin, Me ester, sulfate, 2056¹.
 $C_{12}H_{13}NO_2$ Hederagenic acid, Me ester, oxime, 2057¹.
 $C_{12}H_{13}NO_2$ Hederagenic acid, semicarbazone, 2487¹.
 $C_{12}H_{13}O_2$ Hederagenin, Me ester, 2056¹.
 $C_{12}H_{13}O_2$ Stigmasterol, acetate, 473¹.
 $C_{12}H_{13}O_2$ Δ^1 - Hypogeic anhydride, 2032¹.
 $C_{12}H_{13}O_2$ Palmitic anhydride, 3081¹.
 $C_{12}H_{13}O_2$ Bituminol, 1768¹.
 $C_{12}H_{13}O_2$ Alc. from Rhenish brown coal, 1768¹.
 $C_{12}H_{13}O_2$ Compd., m. above 250¹, from 2,6-bis(hydroxymethyl)-*p*-cresol and resorcinol, 1567¹.
 $C_{12}H_{13}NO_2$ 2 - Naphthol, (*p, p'* - methylenebis-phenyldisazo)bis-, 3267¹.
 $C_{12}H_{13}O_2$ Cyclopentanone, 2,5-bis(*p*-hydroxybenzyl)-, dibenzoate, 1415¹.
 $C_{12}H_{13}N_2O_2$ Naphthionic acid, (*p, p'* - methylenebis-phenyldisazo)bis-, 3267¹.
 $C_{12}H_{13}NO_2$ Pyruvic acid, β, β' -methylenebis(β -benzoyl-, di-Et ester, bisphenylhydrazine, 265¹.
 $C_{12}H_{13}NO_2$ Ketone, 2 - *p*-ridyl 4-quinolyl, phenylhydrazine, dipicrate, 657¹.
 $C_{12}H_{13}CuNO_2$, 2173¹.
 $C_{12}H_{13}O_2$ 3 - Pentanone, 1,5 - bis(4 - hydroxy-m-anisyl)-, dibenzoate, 2943¹.
 $C_{12}H_{13}CuNO_2$, 2173¹.
 $C_{12}H_{13}CrNO_2$, 67¹.
 $C_{12}H_{13}O_2$ *d*-Glucose, tetraacetyl - 6 - triphenylmethyl-, 2479¹.
 $C_{12}H_{13}CuNO_2$, 2173¹.
 $C_{12}H_{13}NO_2$ See Ergotamine.
 $C_{12}H_{13}AsNO_2$ Benzylidimethylphenylarsonium iodide, CHI₃ addn. compd., 1403¹.
 $C_{12}H_{13}InNO_2$ Benzylidimethylphenylammonium iodide, CHI₃ addn. compd., 1403¹.
 $C_{12}H_{13}NO_2$ 3,4(α, β)-Quinocholanic acid, γ -carboxy - 7,13 - diketo-, monosemicarbazone, 252¹.
 $C_{12}H_{13}NO_2$ Tetraacetyl - *d* - glucosido - 1 - pyridinium tetraacetyl - *d* - glucosido - 1-sulfate, 2189¹.
 $C_{12}H_{13}BrNO_2$ Compd. from hydrolysis of goose feathers, 1869¹.
 $C_{12}H_{13}NO_2$ Jessoisacconine, -167¹, 292¹.
 $C_{12}H_{13}O_2$ Cholic acid, 3-anisoyl-, Me ester, 640¹.
 $C_{12}H_{13}NO_2$ Aconine, tetraacetyl deriv., 201^{1,2}.
 $C_{12}H_{13}NO_2$ Japconine, tetraacetyl deriv., 201¹.
 $C_{12}H_{13}NO_2$ Jessoconine, tetraacetyl deriv., 202¹.
 $C_{12}H_{13}O_2$ Hederagenin, monoacetate, 2056¹.
 $C_{12}H_{13}O_2$ Hederagic acid, di-Me ester, 2057¹.
 $C_{12}H_{13}FNO_2$ Spathulatin, and H₂O compd., 289¹, 290¹.
 $C_{12}H_{13}BrNO_2$ Pyromelliteosin, 1273¹.
 $C_{12}H_{13}ClO_2$ Isoviolanthrone, dichloro-, 2335¹.
 $C_{12}H_{13}BrClO_2$ Perylene, 3,9 - bis(*p* - bromobenzoyl) - 4,10 - dichloro-, 2335¹.
 $C_{12}H_{13}ClO_2$ Perylene, 3,9 - dichloro - 4,10 - bis(*p* - chlorobenzoyl)-, 2335¹.
 $C_{12}H_{13}O_2$ Isoviolanthrone, 1568¹, 2335¹.
 $C_{12}H_{13}NO_2$ Violanthrone, 1568¹.
 $C_{12}H_{13}BrO_2$ Perylene, 3,9-dibenzoyl-4,10-dibromo-, 1568¹.
 $C_{12}H_{13}ClO_2$ Perylene, 4,9 - dibenzoyl-4,10-dichloro-, 1568¹.
 $C_{12}H_{13}O_2$ Pyromelliteosin, 1273¹.
 $C_{12}H_{13}NO_2$ Dibenzanthrone, nitro-, 736¹.
 $C_{12}H_{13}NO_2$ Isoviolanthrone, 1568¹.
 $C_{12}H_{13}NO_2$ Hydroquinol, 2 - (3,5 - dihydroxybenzyl)-, tribenzoate, 1266¹.

- Pyrocatechol, 4 - (3,5 - dibromo - 4 - hydroxybenzyl)-, tribenzoate, 1256⁹.
 Resorcinol, β - (3,5 - dibromo - 4 - hydroxybenzyl)-, tribenzoate, 1256⁹.
 $C_{12}H_8Br_2O_2$ p - Cresolresorcinolphthalein, di-K deriv., 2197⁴.
 $C_{12}H_8O_2$ Isophenolphthalein, dibenzoate, 272².
 $C_{12}H_8O_7$ Benzoic anhydride, 5 - hydroxy - 2 - (p - hydroxyphenyl), dibenzoate, 2657⁷.
 $C_{12}H_8NO_2$ Phthalimidine, 3 - (p - hydroxyphenyl)-, 3 - salicyl-, dibenzoate, 272².
 $C_{12}H_8As_2N_2O_4$ Cincophen, 4',4'' - arsenobis[6-methyl-, 1256¹.
 $C_{12}H_8Br_2O_2$ Dipyrroxonium perbromide, tetraphenyl-, 516⁹.
 $C_{12}H_8O_2$ $\alpha\alpha'$ - Dibenzofluorene, 13 - (o - benzyl-oxyphenyl)-, 2945².
 $C_{12}H_8O_2$ $\Delta^4\Delta'$ - Bi - 1,4 - pyran, 2,6,2',6'-tetraphenyl-, 515⁹.
 $C_{12}H_8O_2$ p - Cresolresorcinolphthalein, 2197⁴.
 $C_{12}H_8Br_2O_2$ Bisdiphenylpyrone hydrotribromide, 516⁹.
 $C_{12}H_8N_2$ 1,3 - Cyclobutanediacylonitrile, α,α' - 2,4-tetraphenyl-, 1416⁹.
 $C_{12}H_8O_2$ Carbinol (o - benzyloxyphenyl)di-1-naphthyl-, 2945².
 $C_{12}H_8O_2$ Cyclohexanone, 2,6 - bis(p - hydroxybenzyl)-, dibenzoate, 1415².
 $C_{12}H_8O_2$ 1,1' - Bithioindoxyl, 6,6' - diethoxy-, dibenzoate, 504⁹.
 $C_{12}H_8N_2O_2$ Hydrazine, α,β - bis(diphenylacetyl)- α -phenyl-, 1254².
 $C_{12}H_8N_2O_2$ Benzopurpurin, 1528⁴.
 $C_{12}H_8NO_2$ Benzanilide, 3,4,5 - trisbenzyloxy-, and chloroformate, 2651⁹, 2652¹.
 $C_{12}H_8CuO_2$ 2,4-Pentanedione, 1,5-diphenyl-(?), Cu salt, 1558⁹.
 $C_{12}H_8N_2O_2$ 1,2 - Pyridazinedicarboxylic acid, hexahydro - 4,6 - diketo - 3,3,5,5 - tetraphenyl-, di-Et ester, 1424⁹.
 $C_{12}H_8N_2O_{10}$ Quinine-amine, N - phthalyl-, picrate, 2055⁴.
 $C_{12}H_8O_2$ Leucoatromentum, heptaacetyl-, 639².
 $C_{12}H_8NO_2$ α,α' - β - Xylenediol, dimethyl-amino - $\alpha,\alpha,\alpha',\alpha'$ - tetraphenyl-, 490⁹.
 $C_{12}H_8ClFeN_2O_2$ Hemine, 821, 89².
 $C_{12}H_8N_2O_2$ Addn. compd. of dimethylketene and 1-naphthyl isocyanate, 2189¹.
 $C_{12}H_8N_2O_2$ Tolidine, naphthalenesulfonate, 650⁹.
 $C_{12}H_8N_2O_2$ Bianisidine, naphthalenesulfonates, 650⁹.
 $C_{12}H_8FeN_2O_2$ Hemine, hydroxy-, *derivs.*, 3089⁷.
 $C_{12}H_8O_2$ 9,9' - Bixanthyl, β,β -dibutyl-, 988⁹.
 $C_{12}H_8O_2$ Peroxide, bis(β -butyl-9-xanthyl), 988⁹.
 $C_{12}H_8N_2O_2$ Alanine, N - (naphthylsulfonyl)-, stochrochrysal salt, 972⁴.
 $C_{12}H_8N_2O_2$ Pyrrolidine, 2,4-diphenyl-, oxalate, 2822⁹.
 $C_{12}H_8N_2O_2$ $\Delta^1 - 3$ - Pentenol, acid phthalate, strychnine salt, 2331⁴.
 $C_{12}H_8BeO_2$ Beryllium benzoylcamphor, 488¹.
 $C_{12}H_8N_2O_2$ Stilbene, p,p' - azoxy - α,α' -bis- (N -ethylaniilino)-, di-EtHSO₄ salt, 482².
 $C_{12}H_8NO_2$ 3,4(α,β)-Quinocholanic acid, γ -carboxy-7,13-diketo-, di-Me ester, 252⁴.
 $C_{12}H_8O_2$ Amygdalinic acid, heptaacetate, 731².
 Gentibiose, mandelate, heptaacetate, 276⁹.
 $C_{12}H_8NO_2$ Delphinine, 2600⁹.
 $C_{12}H_8NO_2$ Acorytine, and *derivs.*, 2911⁴, 2911⁴.
 Japaconitine, and *derivs.*, 2901⁴, 2911⁴.
 Pyrojesaconitine, and *derivs.*, 292⁴.
 $C_{12}H_8O_2$ Malolic acid acetate, anhydride with AcOH, 842¹.
 $C_{12}H_8O_2$ Neutral saponin from *Polygal. avara*, 489².
 $C_{12}H_8O_2$ Hispidic acid, 743¹.
 $C_{12}H_8N_2O_2$ Semicarbazide, 1,2,4-tetrazen-zoyl-4-phenylthio-, 2053².
 $C_{12}H_8N_2O_2$ Pyridine, 1-(aminophenyl)-, 1,4-dihydro - 4 - (β - keto - p - phenylidene)-2,6-diphenyl-, picrate, 989⁹.
 $C_{12}H_8N_2O_2$ 1,2 - Propanediol, 3 - triphenyl-bis(p - nitrobenzoate), 2206⁹.
 $C_{12}H_8N_2O_2$ Oxazole, (p -dibenzylaminophenyl)-diphenyl-, 2667⁹.
 $C_{12}H_8O_2$ Benzaurin, dimethyl-, hydrate, dibenzoate, 271⁹.
 Cyclohexanone, 2,6 - bis(p - hydroxybenzyl)-, dibenzoate, 1415².
 $C_{12}H_8O_{10}$ Glucoside, α -methyl-, tetraabenzoate, 250⁷.
 $C_{12}H_8O_{10}$ Glucoside, α -methyl-, tribenzoate, p -toluenesulfonate, 250⁷.
 $C_{12}H_8CrN_2O_{10}$, 67².
 $C_{12}H_8CuN_2O_{10}$, 2173³.
 $C_{12}H_8N_2O_2$ $\Delta^1 - 3$ - Hexenol, acid phthalate, strychnine salt, 2331⁴.
 $C_{12}H_8N_2O_2$ $\Delta^1 - 3$ - Butenol, acid phthalate, brucine salt, 2331⁴.
 $C_{12}H_8NO_2$ Jesaconitine, and *derivs.*, 2921⁴.
 $C_{12}H_8N_2O_2$ 1,2 - Propanediamine, N,N' - di-phenyl-, camphor- β -sulfonate, 492².
 $C_{12}H_8O_2$ Hederagenin, diacetate, 2056⁹.
 $C_{12}H_8O_2$ Hederagenin, acetonyl-, Me ester, 2056⁹.
 $C_{12}H_{70}$ 18-Pentatriacontanone, 1692².
 $C_{12}H_{70}$ Pentatriacontane, 1692².
 $C_{12}H_{27}N_2O_2$ Urea, s -his(2-hydroxyheptadecyl)-, 2027².
 $C_{12}H_8Br_2Cl_2O_2$ o -Cresolphthalein, dibromotetra-chloro-, dibenzoate, 1268¹.
 $C_{12}H_8Cl_2O_2$ o - Cresolphthalein, tetrachloro-, dibenzoate, 1267¹.
 $C_{12}H_8O_2$ Morindone, tribenzoate, 652⁹.
 $C_{12}H_8O_2$ Resorcinolglycerine, tribenzoate, 1568¹.
 $C_{12}H_8N_2O_2$ 2 - Naphthol, 1 - [α,β - bis(p -phenyl azophenylimino)ethyl]-, 828⁹.
 $C_{12}H_8O_2$ 1,3-Thioxol-4(5)-one, 2,2'- p -phenyl enebis[5,5-diphenyl-, 652⁷.
 $C_{12}H_8O_{11}$ $\Delta^{1,2}(2,1')$ - Bibenzofuran - 2 - one 1',1''-oxybis[5,5' - dimethoxy-, 2047².
 $C_{12}H_8N$ Triphenylamine, p,p',p'' -triphenyl-and SbCl₅ addn. compd., 257⁹, 256¹.
 $C_{12}H_{10}O_2$ Compd. from 2-methyl-5-benzofur-anol, 2664⁴.
 $C_{12}H_8NO_2$ Acetamide, dicresylphenyl-, diben-zoate, 271⁹.
 $C_{12}H_8Cl_2N_2Pt$ 2,3-Diamino-5-phenylphenazon-ium chloroplatinate, 2330⁹.
 $C_{12}H_{10}Ge_2$ Digermane, hexaphenyl-, 3250⁹.
 $C_{12}H_{10}Ge_2O_2$ Triphenylgermanium oxide, 3250⁹.
 $C_{12}H_8Br_2N_2O_2$ Addn. compd. of nitroanilin and 1,1'-dibenzyl - 4,4' - bipyridinium dibromide, 2053⁹.
 $C_{12}H_8Cl_2O_2$ 2 - p - Anisyl - 8 - ethoxy - 3 - hydroxybenzopyrylium chloride, FeCl compd., 520¹.
 $C_{12}H_8N_2O_{11}$ Ketone, 1-ethyl-2-pyrrolidyl-4-quinolyl, dipicrolonate, 657¹.
 $C_{12}H_8N_2O_{11}$ Ketone, 6 - methoxy - 4 - quinoly-1 - methyl-2 - pyrrolidyl, dipicrolonate, 657¹.
 $C_{12}H_8NO_2$ α,α' - β - Xylenediol, diethylamino α,α,α' -tetraphenyl-, 490⁹.

- C₂₁H₂₁N₃O₁₇: Quinine-amide, deriv., dipicrate, 2055^o.
- C₂₁H₂₁NO₁₇: + 3H₂O, Compd. from AlCl₃ and benzidine, 2944^o.
- C₂₁H₂₁CdN₂O₈: Carbazide, dipyridine-cadmium-diphenyl, 2259^o.
- C₂₁H₂₁Cl₂N₂O₈: + 6H₂O, Compd. from MgCl₂ and benzidine, 2944^o.
- C₂₁H₂₁Cr₂N₂O₈: Compd. from CrCl₃ and benzidine, 2944^o.
- C₂₁H₂₁Cl₂FeN₂: + 2H₂O, Compd. from FeCl₃ and benzidine, 2944^o.
- C₂₁H₂₁N₂O₁₁: 4 - Quinolinecarbinol, α-(1-methyl-2-piperidyl)-, dipicronate, 656^o.
- C₂₁H₂₁N₂O₁₂: Ketone, α-aminoamyl-6-methoxy-4-quinolyl, dipicronate, 656^o.
- C₂₁H₂₁O₁₂: Δ^{1,3} - 2 - Hexadienone, 6 - phenyl-, trimer, 2941^o.
- C₂₁H₂₁NO₁₂: Lobelanidine, dibenzoyl-, and -HCl, 2828^o.
- C₂₁H₂₁N₂O₁₃: Alanine, N-(naphthylsulfonyl)-, brucine salt, 972^o.
- C₂₁H₂₁Br₂N₂O₁₃: Hematoporphyrin, dibromo-, di-Me ether, 2864^o.
- C₂₁H₂₁O₁₃: Δ^{1,3}-Heptenol, acid phthalate, strychnine salt, 2331^o.
- C₂₁H₂₁N₂O₁₃: Addn. compd. of aniline and 1,1'-dimethyl-4,4'-bipyridinium diiodide, 2053^o.
- C₂₁H₂₁N₂O₁₃: Dipyridylblue iodide, hexamethyl-, 518^o.
- C₂₁H₂₁N₂O₁₃: Addn. compd. of p-phenylenediamine and 1,1'-dimethyl-4,4'-bipyridinium diiodide, 2053^o.
- C₂₁H₂₁O₁₃: Amygdalic acid, heptaacetyl-, Et ester, 501^o.
- Mandelic acid, heptaacetylgentiobioside-, Et ester, 501^o.
- C₂₁H₂₁O₁₃: Trihexosan, nonoacetate, 304^o, 976^o.
- C₂₁H₂₁NO₁₃: Malonic acid, (α-anilinobenzyl)-, dimethyl ester, 1416^o.
- C₂₁H₂₁NO₁₃: See *Bikhoamine*.
- C₂₁H₂₁O₁₃: Hederagenin, Me ester, diacetate, 2056^o.
- C₂₁H₂₁O₁₃: Tarkatogenic acid, and Ag salt, 2930^o.
- C₂₁H₂₁O₁₃: Hexahexosan, 976^o.
- C₂₁H₂₁N₂O₁₃: W₇ + 4H₂O, Piperidinium tungstate, 2191^o.
- C₂₁H₂₁O₁₃: Stearic anhydride, 3081^o.
- C₂₁H₂₁O₁₃: Addn. compd., m. 68^o, of 1,5-diphenyl-3-pentadienone and 1-naphthol-, 1259^o.
- C₂₁H₂₁N₂O₁₃: Pararosaniline, N, N', N''-triphenyl-, 2646^o.
- C₂₁H₂₁NO₁₃: Lobelanidine, dibenzoyl-, methiodide, 2828^o.
- C₂₁H₂₁N₂O₁₃: Δ^{1,3}-Hexenol, acid phthalate, brucine salt, 2331^o.
- C₂₁H₂₁N₂O₁₃: Piperazine, 2-methyl-1,4-diphenyl-, camphor-β-sulfonate, 492^o.
- C₂₁H₂₁N₂O₁₃: 1,2,3,4 - Dibenzofluorindane, 9,16-diphenyl-, 1833^o.
- C₂₁H₂₁N₂O₁₃: 1,4-Naphthoquinone, 2,2'-phenyliminobis[3-anilino], 2620^o.
- C₂₁H₂₁N₂O₁₃: 2,7 - Naphthalenediol, 1-(α,β-bisnaphthyliminoethyl)-, dibenzoate, 829^o.
- C₂₁H₂₁N₂O₁₃: Phthalimidine, 3,3-bis(4-hydroxy-2-phenylazophenyl)-, tri-Ac deriv., 273^o.
- C₂₁H₂₁N₂O₁₃: Quinoxaline, 2,3-bis(α-methoxybenzoyl)phenyl-, 2488^o.
- C₂₁H₂₁N₂O₁₃: Benzophenone, α,α'-bis(p,p'-biphenylene)bishydrazone, 3250^o.
- C₂₁H₂₁N₂O₁₃: Quinidine, phenylhydrazone, dipicrate, 2056^o.
- C₂₁H₂₁N₂O₁₃: Azetodiindole, 5,10,10a,14-tetrahydro-10,11-dimethyl-, oxalate, 657^o.
- C₂₁H₂₁Cl₂O₁₃: Dehydrodesoxycholic acid, bis(p-chlorobenzal)-, 2524^o.
- C₂₁H₂₁N₂O₁₃: 8 - Pentanol, 1 - phenyl-, acid phthalate, cinchonidine salt, 2830^o.
- C₂₁H₂₁O₁₃ + 2H₂O: Dehydrocholic acid, dibenzal-, 2524^o.
- C₂₁H₂₁O₁₃ + 2H₂O: Dehydrodesoxycholic acid, dibenzal-, 2524^o.
- C₂₁H₂₁CuN₂O₁₃: 3 - Isopyrrolicarboxylic acid, 2 - [(3 - carboxy - 4,5 - dimethyl - 2 - pyrrol)methylene] - 4,5 - dimethyl-, di-Et ester, Cu deriv., 3271^o.
- C₂₁H₂₁N₂O₁₃: Diphenimide acid, N, N'-diphenyl-bis(diethylaminoethyl)ester, and di-Et ester, 1703^o.
- C₂₁H₂₁N₂O₁₃: Ethylene, tetrakis(3-carboxy-4,5-dimethyl-2-pyrrol)-, tetra-Et ester, 3270^o.
- C₂₁H₂₁N₂O₁₃: 3 - Pyrrolicarboxylic acid, 2,2'-2,2'' - acetylenetetrakis[4,5 - dimethyl-, tetra-Et ester, 3270^o.
- C₂₁H₂₁O₁₃: Acetic acid, diacetaderyl-, 1127^o.
- C₂₁H₂₁ClN₂O₁₃: 1,2,3,4 - Dibenzofluorindane, 9,16-diphenyl-, methochloride, 1283^o.
- C₂₁H₂₁N₂O₁₃: Hydrazine, tri-9-xanthyl-, 3480^o.
- C₂₁H₂₁N₂O₁₃: Urea, bis(triphenylmethyl)-, 2479^o.
- C₂₁H₂₁CoN₂O₁₃: Metachrome brown B, cobaltic lake, 220^o.
- C₂₁H₂₁N₂O₁₃: 4,5' - Bipyrrrole - 3 - carboxylic acid, 5,5' - p - nitrobenzalbis[4' - hydroxy - 2,2' - dimethyl-, tetra-Et ester, 75^o.
- C₂₁H₂₁N₂O₁₃: α - Terpineol, acid phthalate, strychnine salt, 486^o.
- C₂₁H₂₁N₂O₁₃: 4,5' - Bipyrrrole - 3 - carboxylic acid, 5,5' - benzalbis[4' - hydroxy-2,2'-dimethyl-, tetra-Et ester, 75^o.
- C₂₁H₂₁BrO₁₃: Hederagenin acid, Me ester, α-bromobenzoate, 2057^o.
- C₂₁H₂₁O₁₃: Malonic acid, diacetaderyl-, 2127^o.
- C₂₁H₂₁N₂O₁₃: αγ - Dibenzophenazine, 2,7 - bis(2-hydroxy-1-naphthylazo)-, 2491^o.
- C₂₁H₂₁O₁₃: 1,2 - Naphthoquinone, 3 - [3,4-dihydroxy - 1 - (2 - naphthylsulfonyl)-2-naphthyl]-4-(2-naphthylsulfonyl)-, 3088^o.
- C₂₁H₂₁ClO₁₃: Phenol, p,p',p''-(chloromethenyl)-tris-, tribenzoate, 649^o.
- C₂₁H₂₁As₂Cl₂O₁₃: Oxide, bis(di-1-naphthylarsyl), tetrachloride, 3086^o.
- C₂₁H₂₁As₂O₁₃: Oxide, bis(di-1-naphthylarsyl), 3086^o.
- C₂₁H₂₁Br₂N₂O₁₃: Bibenzyl, p,p' - azoxy - α,α'-bis(N-benzoylamino) - q,α' - dibromo-, 482^o.
- C₂₁H₂₁N₂O₁₃: Diphenamic acid, N, N' - p - biphenylenebis-, 2190^o.
- C₂₁H₂₁O₁₃: Carbinol, tris(p-hydroxyphenyl)-, tribenzoate, 649^o.
- C₂₁H₂₁O₁₃: 9,9' - Bixanthyl-, 9,9'-dibenzyl-, 988^o.
- C₂₁H₂₁O₁₃: Peroxide, bis(9-benzyl-9-xanthyl)-, 988^o.
- C₂₁H₂₁N₂O₁₃: Bibenzyl, p,p' - azoxy - α,α' - bis(N-benzoylamino) - α,α' - dibromo-, 482^o.
- C₂₁H₂₁N₂O₁₃: Diphenylamine, 4,4'' - (3-methyl-4-phenylimino - p-phenylenedimethylene)-bis[2-methyl-, -HCl, 2490^o].
- C₂₁H₂₁N₂O₁₃: Anthranilic acid, N-1-naphthyl-N-phenyl-, morphine salt, 511^o.
- C₂₁H₂₁N₂O₁₃: Diphenylamine, 4,4'' - methenyl-tris[2-methyl-, 2490^o].
- C₂₁H₂₁N₂O₁₃: Anthranilic acid, α-N-phenyl-N-p-tolyl-, quinine salt, 511^o.

- $C_{10}H_{12}N_2O_3$ 3 - Pentanol, 1-phenyl-, acid phthalate, strychnine salt, 2330⁹.
- $C_{10}H_{14}Cl_2N_2$ Terephthal green, 490⁴.
- $C_{10}H_{16}O_7 + 2H_2O$ Dehydrocholic acid, dianisal-, 252².
- $C_{10}H_{17}ClN_2O_3$ Acetic acid, chlorosulfo-, cinchonine salt, 1128².
- $C_{10}H_{22}NO_{14}$ Japaconitine, triacetyl deriv., 290⁹, 291¹.
- $C_{10}H_{22}O_{17}$ Glucosidoglucosidoglucose, undecaacetate, 975⁹.
- $C_{10}H_{14}BrO_2$ Hederagic acid, *ti*-Me ester, ω -bromobenzoate, 2057².
- $C_{10}H_{17}O_4V_2 + 2H_2O$, 2174².
- $C_{10}H_{18}O_4$ Bufotoxin, 253³.
- $C_{10}H_{17}NO_2$ Phthalimidine, 2-benzoyl-3-(*p*-hydroxyphenyl)-3-salicyl-, dibenzoate, 272².
- $C_{10}H_{17}N_2O_2$ Phthalimidine, 2-benzamido-3,3-bis(*p*-hydroxyphenyl)-, dibenzoate, 272².
- , 2-benzamido-3-(*p*-hydroxyphenyl)-3-salicyl-, dibenzoate, 272².
- $C_{11}H_{15}As_2N_2O_{11}$ Carbanilide, *p,p'*-bis[*m*[(*p*-arsenophenyl)carbamyl]phenylcarbamyl], 79⁹.
- $C_{11}H_{18}O_2$ Cyclohexanol, 2,6-bis(*p*-hydroxybenzyl)-, tribenzoate, 1415².
- $C_{11}H_{17}N_3O_4$ Anthranilic acid, *N*-phenyl-*N*-*p*-tolyl-, strychnine salt, 511⁷.
- $C_{11}H_{16}O_2$ Lignol, 1131⁹.
- $C_{11}H_{17}N_2O_5$ α -Terpineol, acid phthalate, brucine salt, 489⁹.
- $C_{11}H_{17}NO_6P$ See *Cephalin*.
- $C_{12}H_{12}Br_2$ $\Delta^{12,13}$ - Bi - α, α' - dibenzofluorene, dibromo-, 1860⁹.
- $C_{12}H_{12}$ $\Delta^{12,13}$ - Bi - α, α' - dibenzofluorene, 1860².
- $C_{12}H_{12}N_2O_4$ $\alpha\gamma$ -Dibenzophenazine, 2,7 - bis(3-carboxy - 2 - hydroxy - 1 - naphthylazo) -, 2491⁴.
- $C_{12}H_{12}O_4$ $\Delta^{10,11}$ - Bianthrone, 3,6' - dihydroxy-, dibenzoate, 3269⁹.
- $C_{12}H_{12}$ $\Delta^{13,13'}$ - Bi - α, α' - dibenzofluorene, 1860¹.
- $C_{12}H_{12}$ Ethylene, tetra-1-naphthyl-, 1859⁸.
- $C_{12}H_{12}N_2O_4$ Quazole, *p,p'* - azoxybis[2,4,5-triphenyl-], 2667⁷.
- $C_{12}H_{12}$ Indene, 1,3-diphenyl-1- α -diphenylmethyl-enphenethyl-(?), 1411¹.
- , 1,3 - diphenyl - 1 - α, γ, γ' - triphenyl-diol-(?), 1411¹.
- Propadiene, 1,1,3-triphenyl-, dimer, 1410⁷.
- Truxan, tetraphenyl-, 826⁹.
- $C_{12}H_8Cl_2O_2$ *p*-Dioxane, 2,5 - dichloro - 2,5-bis(triphenylmethyl)-, 2206⁹.
- $C_{12}H_{18}O$ Ether, bis(1,3,3 - triphenylallyl), 826⁹.
- $C_{12}H_{18}O_2$ *p*-Dioxane, 2,5 - bis(triphenylmethyl)-, 2206⁹.
- $C_{12}H_{17}Cl_2N_2$ Compd. from 2 - (*m* - aminophenyl)-4,5 - diphenylimidazole and $PhCH_2Cl$, *m*. 172², 2494⁷.
- $C_{12}H_{18}O_2$ Methyl, (dimethoxyphenyl)diphenyl-, peroxide, 2946⁷.
- $C_{12}H_{18}O_5$ *d*-Glucose, acetonedibenzoyltriphenylmethyl-(?), 2479².
- $C_{12}H_{14}Cu_2Fe_2N_4S_8$, 619⁹.
- $C_{12}H_{14}O_{11}$ Glucoside, 6(?) - β -glucosido- α -methyl-, tetraacetate, tribenzoate, 250⁹.
- $C_{12}H_{14}O_7$ Tribenzoate, *m*. 164.5², of compd. from lupulone, 2048².
- $C_{12}H_{15}ClN_2O_3$ Acetic acid, chlorosulfo-, quinine salt, 1128².
- $C_{12}H_{10}$ Benzene, *o*-bis(β -octahydroanthrylbutyl)-, 1270⁹.
- $C_{12}H_{17}N_2O_{10}$ Hydrocupreine succinate, 1426¹.
- $C_{14}H_{16}O_4$ Carbinol, tris(4-benzyloxy-*m*-tolyl)-, 2486⁹.
- $C_{14}H_{17}N_2O_3$ 3 - Hexanol, 1 - phenyl-, acid phthalate, brucine salt, 2330⁹.
- $C_{14}H_{17}N_2O_2$ Leucoisoidigo, tetra-*Bz* deriv., 2204⁹.
- $C_{14}H_{17}Br_2N_2O_2$ Addn. compd. of 2-naphthol and 1,1' - dibenzyl - 4,4' - bipyridinium dibromide, 2053³.
- $C_{14}H_{17}Br_2N_4$ Addn. compd. of 2 - naphthylamine and 1,1' - dibenzyl - 4,4' - bipyridinium dibromide, 2053³.
- $C_{14}H_{17}N_2O_3$ 1 - Propanol, 1,3 - diphenyl-, acid phthalate, strychnine salt, 2331¹.
- $C_{14}H_{17}N_2O_5$ Picrate, *m*. 150², decompn., of reduction product from α -(1-methyl-2-piperidyl)-4-quinolinecarbinol, 659⁹.
- $C_{14}H_{17}N_2O_4$ Benzoic acid, *o*-[*p*-(β -anilino- α -methylpropylamino)phenylazo]-, strychnine salt, 2936⁹.
- $C_{14}H_{17}ClN_2O_3$ Acetic acid, chlorosulfo-, strychnine salt, 1128².
- $C_{14}H_{17}N_2O_4 + H_2O$ Oxime of ketone from desoxy-bilanic acid, 253².
- $C_{14}H_{19}O_4V_2$, 2174².
- $C_{14}H_{15}As_2Cl_2N_2O_5$, 1526⁴.
- $C_{14}H_{15}Br_2O_4$ Hederagenin, *di o*-bromobenzoate, 2056⁹.
- $C_{14}H_{15}O_4$ Hederagenin, dibenzoate, 2056⁹.
- $C_{14}H_{17}N_2O_5$ α - Benzophenazine, 6 - [3,4 - dihydroxy - 1 - (2 - naphthylsulfinyl) - 2 - naphthyl] - 5 - (2 - naphthylsulfinyl)-, 3088^{2,7}.
- $C_{14}H_{17}O_2$ Phenylresorcinolphthalen, dibenzoate, 2197⁴.
- $C_{14}H_{17}O_4$ Methyl, (3 - hydroxy - 2 - naphthyl)-diphenyl-, peroxide, 2945⁴.
- $C_{14}H_{17}N_3O_4$ Anthranilic acid, *N* - 1 - naphthyl-*N* - phenyl-, brucine salt, 511⁷.
- $C_{14}H_{17}N_3O_4$ Caproic acid, ϵ - *N* - methylbenzamido - α - 4 - quinolylformyl-, Et ester, dipicolonate, 556⁷.
- $C_{14}H_{17}N_2$ Addn. compd. of aniline and 1,1'-diphenyl - 4,4' - bipyridinium diiodide, 2053³.
- $C_{14}H_{17}N_2O_3$ 1 - Propanol, 1,3 - diphenyl-, acid phthalate, brucine salt, 2331¹.
- $C_{14}H_{17}N_2O_4 + 8H_2O$, 1,2 - Cyclobutanedicarboxylic acid, quinine salt, 474⁴.
- $C_{14}H_{17}Br_2O_4$ Hederagenin, Me ester, bis(*o*-bromobenzoate), 2056⁹.
- $C_{14}H_{18}O_2$ Hispidic acid, hexaacetate, 743¹.
- $C_{14}H_{18}O_2$ Glucoside, methyltriphenylmethyl-, tribenzoate, 250⁹.
- $C_{14}H_{17}InN_2$ Tribenzylmethylammonium iodide, CHI addn. compd., 1403².
- $C_{14}H_{17}NO_2$ Compd. from the brain, 2695⁹.
- $C_{14}Fe_2N_2O_8 + 4H_2O$, 2609⁹.
- $C_{14}H_{17}Br_2N_2O_2$ Dehydrofluorocyclene, dibromotetranitro-, 2199⁹.
- $C_{14}H_{17}Br_2$ Dehydrofluorocyclene, α, α' -dibromo-, 2199⁹.
- $C_{14}H_{17}Br_2Q_4S_8$ Dehydrofluorocyclenetetrasulfonic acid, dibromodihydroxy-, and *Ba* salt, 2199⁹.
- $C_{14}H_{17}N_2O_2$ Fluorocyclene, tetranitro-, 2199⁹.
- $C_{14}H_{17}Br_2$ Fluorocyclene, tetrabromo-, 2199⁹.
- $C_{14}H_{17}N_2O_4$ Fluorocyclene, α, α' - dinitro-, 2199⁹.
- $C_{14}H_2Co_2O_2S_2$ Diamond black PV, cobaltic lake of oxidized, 229⁹.
- $C_{14}H_{17}F_4$ Fluorocyclene, 2199⁹.
- $C_{14}H_{17}O_4S_4$ Fluorocyclenetetrasulfonic acid, hydroxy-, and salts, 2199⁹.

- $C_{12}H_{12}CrN_2O_{10}S_2$ Diamond black PV, chromic lake, 220°.
- $C_{12}H_{12}Cl_2N_2O_8$ *p*-Dioxane, 1,5-dichloro-2,5-bis-(diphenylmethyl)-, picrate, 2206°.
- $C_{12}H_{12}FeN_2O_{10}S_2 + 16H_2O$, 619°.
- $C_{12}H_{12}O_8$ Methyl *o*-shisyl-1-naphthylphenyl-, peroxide, 2245°.
- , (3-methoxy-2-naphthyl)diphenyl-, peroxide, 2245°.
- $C_{12}H_{12}CoN_2O_{10}S_2$ Diamond black PV, roseocobaltic salt of cobaltic lake of oxidized, 220°.
- $C_{12}H_{12}N_2O_8$ *p*-Dioxane, 2,5-bis-(triphenylmethyl)-, picrate, 2206°.
- $C_{12}H_{12}Ge_2O_8$ Germanediol, tetraanhydrotetrakis-diphenyl-, 3259°.
- $C_{12}H_{12}Ge_2O_8$ Germanediol, trianhydrotetrakis-diphenyl-, 3259°.
- $C_{12}H_{12}BrN_2O_8$ Addn. compd. of pyrocatechol and 1,1'-dibenzyl-4,4'-bipyridinium dibromide, 2053°.
- $C_{12}H_{12}ClN_2O_8$ Addn. compd. of pyrocatechol and 1,1'-dibenzyl-4,4'-bipyridinium dichloride, 2053°.
- $C_{12}H_{12}BrN_2O_8$ Addn. compd. of aniline and 1,1'-dibenzyl-4,4'-bipyridinium dibromide, 2053°.
- $C_{12}H_{12}ClN_2O_8$ Addn. compd. of *p*-phenylenediamine and 1,1'-dibenzyl-4,4'-bipyridinium dichloride, 2053°.
- $C_{12}H_{12}I_2N_2O_8$ Addn. compd. of *p*-phenylenediamine and 1,1'-dibenzyl-4,4'-bipyridinium diiodide, 2053°.
- $C_{12}H_{12}CoN_2O_{10}S_2$ Diamond black PV, diroseocobaltic salt of cobaltic lake of oxidized, 220°.
- $C_{12}H_{12}BrN_2O_8$ Addn. compd. of *p*-phenylenediamine and 1,1'-dibenzyl-4,4'-bipyridinium dibromide, 2053°.
- $C_{12}H_{12}N_2O_8$ Addn. compd. of 1,5-bis(*p*-dimethylaminophenyl)-3-pentadienone and escorcinol, 1265°.
- $C_{12}H_{12}Cl_2N_2ZnS_2$ Terephthal brilliant green, 490°.
- $C_{12}H_{12}N_2O_8$ Azoxybenzene, *p,p'*-bis(triphenylmethyl)-, 2037°.
- $C_{12}H_{12}O_8$ Aurin peroxide, triacetyl-, 649°.
- $C_{12}H_{12}O_8$ Peroxide, bis[tris(3-methyl-*p*-anisyl)-methyl]-, 418°.
- $C_{12}H_{12}N_2O_8S_2$ Carbanilide, *m,m'*-bis[5-(4,6,8-trisulfo-1-naphthylcarbamyl)-*o*-tolylcarbamyl]-, P 1931°.
- $C_{12}H_{12}AlO_8$ Camphor, benzoyl-, Al deriv., 2334°.
- $C_{12}H_{12}CoN_2O_{10}S_2$ Benzoic acid, *o*-(2-hydroxy-6-sulfo-1-naphthyl)azo-, diroseocobaltic salt of Co lake of, 220°.
- $C_{12}H_{22}O_8$ Palmitin, 3396°.
- $C_{12}H_{12}Cl_2N_2O_8$ Aspartic acid, *N*-(*β*-trichloroethylidene)-, dibrucine salt, 2640°.
- $C_{12}H_{12}CoN_2O_{10}S_2 + 17H_2O$, 619°.
- $C_{12}H_{12}CoN_2O_{10}S_2$ 2-Naphthol-6-sulfonic acid, 1-(*m*-acetylphenyl)azo-, tri-NH₂ roseocobaltic salt, 220°.
- $C_{12}H_{12}O_8$ See *Intarvin*.
- $C_{12}H_{12}Cl_2N_2O_8$ Benzyl alcohol, bis(2-amino-4-phenyl-5-thiazyl)-*p*-chloro-, oxalate, 513°.
- $C_{12}H_{12}N_2O_8$ Benzyl alcohol, *α,α*-bis(2-amino-4-phenyl-5-thiazyl)-oxalate, 513°.
- $C_{12}H_{12}N_2O_8$ Benzyl alcohol, *α,α*-bis(2-amino-4-phenyl-5-thiazyl)-oxalate, 513°.
- $C_{12}H_{12}N_2O_8$ Acridine, diaminotetramethyl-, (3HCl-2HCl salt, 501°.
- $C_{12}H_{12}N_2O_8$ Aspartic acid, *N*-*p*-nitrobenzal-, dibrucine salt, 2639°.
- $C_{12}H_{12}N_2O_8$ Aspartic acid, *N*-salicylal-, dibrucine salts, 2639°.
- $C_{12}H_{12}O_8$, 3027°.
- $C_{12}H_{12}O_8$ See *Olavin*.
- $C_{12}H_{12}N_2O_8$ Glutamic acid, *N*-salicylal-, dibrucine salt, 2640°.
- $C_{12}H_{12}N_2O_8$ *d*-Glutamic acid, triphenylmethyl-, phenylhydrazide, tetrabenzoate, 247°.
- $C_{12}H_{12}O_8$ Addn. compd. of benzohydrol and 2-naphthol, 1703°.
- $C_{12}H_{12}CoN_2O_{10}S_2$ Palatine chrome black 6B, cobaltic lake of, 220°.
- $C_{12}H_{12}CrN_2O_{10}S_2$ Palatine chrome black 6B, cobaltic lake of, 220°.
- $C_{12}H_{12}CoN_2O_{10}S_2$ Eriochrome red B, cobaltic lake, 220°.
- $C_{12}H_{12}CrN_2O_{10}S_2$ Eriochrome red B, chromic lake, 220°.
- $C_{12}H_{12}FeN_2O_8 + 36H_2O$, 619°.
- $C_{12}H_{12}N_2O_8$ Benzyl alcohol, *α,α*-bis(2-amino-4-phenyl-5-thiazyl)-*p*-dimethylamino-, oxalate, 513°.
- $C_{12}H_{12}CoN_2O_{10}S_2$ Eriochrome red B, diroseocobaltic salt of cobaltic lake of, 220°.
- $C_{12}H_{12}CoN_2O_{10}S_2$ Palatine chrome black 6B, diroseocobaltic salt of cobaltic lake of, 220°.
- $C_{12}H_{12}CoN_2O_{10}S_2$ Eriochrome red B, diroseocobaltic salt of cobaltic lake of, 220°.
- $C_{12}H_{12}N_2O_8$ Benzoic acid, methylenedis(nitro-, dibrucine salt, 3267°, 3268°.
- $C_{12}H_{12}N_2O_8$ Benzoic acid, *o,o'*-methylenedis-, dibrucine salt, 3267°.
- $C_{12}H_{12}CrN_2O_{10} + 5H_2O$, 671°.
- $C_{12}H_{12}NO_8$ Addn. compd., m. 126-8°, of *α*-1-naphthyl-*p*-phenylbenzohydrol with pyridine, 2045°.
- $C_{12}H_{12}N_2O_8$ Aniline, *N,N'*-(2,3-butylene)-bis[*p*-(*p*-sulfophenylazo)-], cinchonidine salt, 2936°.
- $C_{12}H_{12}O_8$ Addn. compd. of 1,5-di-*p*-anisyl-3-pentadienone and naphthol, 1258°.
- $C_{12}H_{12}O_8$ Palmitic acid, penterythritol ester, 759°.
- $C_{12}H_{12}N_2O_8S_2$ Aniline, *N,N'*-(2,3-butylene)-bis[*p*-(*p*-sulfophenylazo)-], strychnine salt, 2936°.
- $C_{12}H_{12}BrN_2$ Addn. compd. of Ph₂NH and 1,1'-dibenzyl-4,4'-bipyridinium dibromide, 2053°.
- $C_{12}H_{12}N_2O_8$ Aniline, *N,N'*-(2,3-butylene)-bis[*p*-(*p*-sulfophenylazo)-], brucine salt, 2936°.
- $C_{12}H_{12}Ag_2N_2O_8$ Compd. from silver isatin and BrCl, 2050°.
- $C_{12}H_{12}O_8$ Aurin peroxide, tribenzoyl-, 649°.
- $C_{12}H_{12}N_2O_8 + 2H_2O$ 1,1,2,3-Cyclopropenetracarboxylic acid, brucine salt, 246°.
- $C_{12}H_{12}I_2$ Dodecandene, iodo-, 493°.
- $C_{12}H_{12}O_8 + H_2O$ Hydrate, m. 96-8°, of *α*-1-naphthyl-*p*-phenylbenzohydrol, 2045°.
- $C_{12}H_{12}O_{10}$ Amylodextrinic acid, and salts, 1260°.
- CaO_2 , 2163°.
- $CaCl_2$ See Calcium chloride.
- $CaCl_2O_8$ See Calcium hypochlorite.
- $CaCl_2Pb + 6H_2O$ Calcium lead chloride, 2051°.
- CaF_2 See Calcium fluorides; Fluorites.
- CaF_2Si See Calcium silicofluoride.
- $CaFeSi_2O_8$ See *Agassite*.
- CaH_2 See Calcium hydride.
- CaH_2O_8 See Calcium hydroxide.

- CaH_2O_8 ; See Calcium sulfates.
 $\text{CaH}_2\text{O}_8\text{Si}_2 + \text{H}_2\text{O}$ See Okenite.
 CaH_2O_7 ; See Calcium hypophosphate.
 CaHg_4 , 2162.
 $\text{CaLiMn}_2\text{O}_8 + 4\text{H}_2\text{O}$, 1385.
 $\text{CaNa}_2\text{O}_8\text{Si}_2$; See Reaumurite.
 CaO See Lime.
 CaO_2 See Calcium oxides.
 CaO_3 See Calcium sulfite.
 CaO_3Si See Radiophyllite; Wollastonite.
 CaO_3 See Anhydrite; Gypsum; Selenite.
 CaO_3Se See Calcium selenate.
 CaO_3W See Calcium tungstate; Scheelite.
 CaO_3SiTi See Titanite.
 CaO_3P ; See Calcium phosphates.
 $\text{CaO}_3\text{Mn}_2 + 4\text{H}_2\text{O}$ See Calcium permanganate.
 $\text{CaO}_3\text{P}_2\text{V}_2 + 5\text{H}_2\text{O}$ See Sincosite.
 $\text{CaO}_3\text{U}_2\text{V}_2 + x\text{H}_2\text{O}$ See Tsyngamunite.
 $\text{CaO}_3\text{U}_2\text{Y}_2 + 20\text{H}_2\text{O}$ See Rawite.
 CaPb , 2162.
 CaPb_2 , 2162.
 CaS See Calcium sulfide.
 CaSn , 2162.
 CaSn_2 , 925, 2102.
 CaZn , 2162.
 CaZn_2 , 2162.
 CaZn_3 , 2162.
 $\text{Ca}_2\text{HNaO}_3\text{Si}$; See Padolite.
 $\text{Ca}_2\text{H}_2\text{O}_3\text{Si}_2 + \text{H}_2\text{O}$ See Grolite.
 Ca_2Pb , 2162.
 Ca_2Pb_2 , 787.
 Ca_2Sn , 2162.
 Ca_2Zn_2 , 2162.
 $\text{Ca}_2\text{Fe}_2\text{O}_3\text{Si}_2$; See Melanite.
 Ca_2Hg_2 , 787.
 Ca_2Hg_3 , 2162.
 $\text{Ca}_2\text{Na}_2\text{O}_3\text{P}_2$; See Merrilite.
 $\text{Ca}_2\text{O}_3\text{Si}_2 + 3\text{H}_2\text{O}$ See Afwillite.
 Ca_2P_2 ; See Calcium phosphide.
 $\text{Ca}_2\text{ClO}_3\text{P}_2$; See Chlorapatite.
 $\text{Ca}_2\text{FO}_3\text{P}_2$; See Apatite.
 $\text{Ca}_2\text{H}_2\text{O}_3\text{Si}_2 + 2\text{H}_2\text{O}$ See Foshagite.
 $\text{Ca}_2\text{H}_2\text{O}_3\text{Si}_2$; See Xenolite.
 Ca_2Sn , 787.
 Ca_2Zn , 787.
 CbN See Columbium nitride.
 Cb_2FeO_3 ; See Columbite.
 Cb_2O_3 ; See Columbium oxides.
 Cb_2O_4 ; See Columbium oxides.
 CdCl_2 ; See Cadmium chloride.
 CdCu , 1686.
 CdI_2 ; See Cadmium iodide.
 $\text{CdLiMn}_2\text{O}_8 + 4\text{H}_2\text{O}$, 1385.
 $\text{CdLiMn}_2\text{O}_8 + 5\text{H}_2\text{O}$, 1385.
 $\text{CdK}_2\text{O}_3\text{Si}_2$, 619.
 CdMn_2O_8 ; See Cadmium permanganate.
 CdO See Cadmium oxide.
 CdO_3 See Cadmium sulfate.
 CdS See Cadmium sulfide.
 $\text{Cd}_2\text{O}_3\text{Si}$, 619.
 $\text{Cd}_2\text{Ce}_2\text{N}_2\text{O}_8 + 2\text{H}_2\text{O}$ Cadmium cerium nitrate, 2309.
 Cd_2Cu , 1686.
 Cd_2Cu_2 , 1686.
 Cd_2Cu_2 , 1686.
 $\text{Cd}_2\text{La}_2\text{N}_2\text{O}_8 + 24\text{H}_2\text{O}$ Cadmium lanthanum nitrate, 2309.
 $\text{Cd}_2\text{Na}_2\text{Nd}_2\text{O}_8 + 24\text{H}_2\text{O}$ Cadmium neodymium nitrate, 2309.
 $\text{Cd}_2\text{O}_3\text{Si}$, 619.
 CeCl_3 See Cerium chlorides.
 $\text{CeH}_2\text{N}_2\text{O}_8$ Ammonium cerium nitrate, 425.
 CeI_2 See Cerium iodides.
 CeNiO_3 See Cerium nitrate.
 $\text{CeN}_2\text{NiO}_8 + 8\text{H}_2\text{O}$ Cerium nickel nitrate
 CeO_2 ; See Cerium oxides.
 $\text{Ce}_2\text{Cu}_2\text{N}_2\text{O}_8 + 4\text{H}_2\text{O}$, 2174.
 Ce_2O_2 ; See Cerium oxides.
 Ce_2O_3 ; See Cerium sulfate.
 $\text{ClCoH}_2\text{N}_2\text{O}_4$, 3069.
 $\text{ClCoH}_2\text{N}_2\text{O}_5$, 617.
 $\text{ClCoH}_2\text{N}_2\text{O}_6$, 617.
 $\text{ClCoH}_2\text{N}_2\text{O}_7$, 617.
 $\text{ClCoH}_2\text{N}_2\text{O}_8$, 3070.
 $\text{ClCo}_2\text{H}_2\text{N}_2\text{O}_5$, 617.
 ClCs See Cesium chloride.
 ClCu See Copper chlorides.
 ClH See Hydrochloric acid.
 ClHmg , 3227.
 ClHO See Hypochlorous acid.
 ClHO_2 ; See Chlorous acid.
 ClHO_3 ; See Chloric acid.
 ClHO_3S See Chlorosulfonic acid.
 $\text{ClHO}_4 + \text{H}_2\text{O}$ See Perchloric acid.
 ClHNO Chloramine, 944.
 ClH_2NO Nitronium monoperchlorate, 2312.
 ClH_2O_2 Oxonium perchlorate, 943.
 ClHN See Ammonium chloride.
 ClHNO_2 See Ammonium perchlorate.
 ClHgI , 787, 2919.
 ClHgO_2 See Mercury perchlorate.
 ClK See Potassium chloride; Sulfate
 ClKO See Potassium chlorate.
 ClKO_2 See Potassium perchlorate.
 ClK_2NO_8 Potassium chloriminosulfonate, 3227.
 $\text{ClLi}_2\text{N}_2\text{NaO}_8$, 3070.
 ClLi See Lithium chloride.
 $\text{ClMoO} + 4\text{H}_2\text{O}$ Molybdanyl chloride, 618.
 ClNO See Nitrosyl chloride.
 ClNO_2 Nitryl chloride, 1245.
 ClN_2 Hydrazoic acid, chloro-, 1253.
 ClNa See Halite; Sodium chloride.
 ClNaO See Sodium hypochlorite.
 ClNaO_2 See Sodium chlorate.
 ClO_2 See Chlorine oxides.
 ClRb See Rubidium chloride.
 ClS See Sulfur chlorides.
 ClTi See Thallium chlorides.
 ClCo See Cobalt chloride.
 $\text{ClCoH}_2\text{N}_2\text{O}_5$, 617.
 $\text{ClCoH}_2\text{N}_2\text{O}_6$, 3069.
 ClCr See Chromium chlorides.
 ClCu See Copper chlorides.
 ClCu_2 See Copper chlorides.
 ClFe See Iron chlorides.
 ClFeH_2N_6 , 1232.
 $\text{ClFeH}_2\text{N}_6\text{O}_8$, 1232.
 ClH_2NO_8 Nitronium diperchlorate, 2312.
 ClHg See Mercury chlorides.
 ClHg_2O_3 , 787.
 ClHg_2O_4 , 1105.
 ClHg_2O_5 , 1105.
 ClHg_2O_6 See Bischofite; Magnesium chlorid
 ClMgO_3 See Magnesium perchlorate.
 ClNi See Nickel chloride.
 ClO See Chlorine oxides.
 ClOS See Thionyl chloride.
 ClO_2 See Selenium oxychloride.
 ClO_3 See Sulfuryl chloride.
 ClO_2Zn See Zinc hypochlorite.
 ClO_3 See Chlorine oxides.
 ClPb See Lead chlorides.
 ClPd See Palladium chloride.
 ClPt See Platinum chloride.
 ClS See Sulfur chlorides.
 ClS_2 See Sulfur chlorides.
 ClS_3 See Sulfur chlorides.
 ClS_4 See Sulfur chlorides.

[illegible]

$\text{Cr}_2\text{Na}_2\text{O}_7$ See Sodium dichromate.
 Cr_2O_3 See Chromium oxides.
 $\text{Cr}_2\text{H}_2\text{N}_2\text{O}_5\text{S}_2 + \text{H}_2\text{O}$, 788².
 $\text{Cr}_2\text{La}_2\text{O}_{15} + 8\text{H}_2\text{O}$, Lanthanum chromate, 19².
 $\text{Cr}_2\text{Nd}_2\text{O}_{12} + 8\text{H}_2\text{O}$, Neodymium chromate, 19².
 $\text{Cr}_2\text{O}_2\text{Pr}_2 + 8\text{H}_2\text{O}$, Praseodymium chromate, 19².
 $\text{Cr}_2\text{O}_2\text{Sm}_2 + 8\text{H}_2\text{O}$, Samarium chromate, 19².
 $\text{Cr}_2\text{K}_2\text{La}_2\text{O}_{16}$, 20¹, 2459².
 $\text{Cr}_2\text{H}_2\text{N}_2\text{O}_5\text{S}_2 + 2\text{H}_2\text{O}$, 788².
 $\text{Cr}_2\text{H}_2\text{La}_2\text{O}_{14} + 2\text{H}_2\text{O}$, 2459².
 $\text{Cr}_2\text{H}_2\text{La}_2\text{O}_{13} + 2\text{H}_2\text{O}$, 2459².
 $\text{Cr}_2\text{H}_2\text{La}_2\text{O}_{12} + 2\text{H}_2\text{O}$, 2459².
 $\text{Cr}_2\text{H}_2\text{La}_2\text{O}_{10} + 4\text{H}_2\text{O}$, 2459².
 CsF See Cesium fluoride.
 CsHO See Cesium hydroxide.
 CsMnO_4 See Cesium permanganate.
 $\text{Cs}_2\text{H}_2\text{O}_8$, 2609².
 $\text{Cs}_2\text{H}_2\text{O}_8$, 2609².
 $\text{Cs}_2\text{I}_2\text{MnO}_{11}$ Cesium manganese iodate, 1385⁴.
 $\text{Cs}_2\text{I}_2\text{MnO}_{11}$ Cesium manganese iodate, 1385².
 Cs_2O_8 See Cesium sulfate.
 Cs_2O_8 See Cesium selenate.
 CuFeS_2 See Chalcopyrite.
 CuH See Copper hydride.
 CuHO See Copper hydroxides.
 CuH_2O_2 See Copper hydroxides.
 CuH_2O_2 See Copper hydroxides.
 CuH_2O_2 See Copper hydroxides.
 CuHg , 1798².
 CuI See Copper iodide.
 $\text{Cu}_2\text{Mn}_2\text{O}_{11} + 4\text{H}_2\text{O}$, 1385².
 $\text{Cu}_2\text{Mn}_2\text{O}_{12} + 4\text{H}_2\text{O}$, 1385².
 CuMg_2 , 2014².
 CuNO_3 See Copper nitrate.
 CuO See Copper oxides.
 CuO_2 See Copper sulfate.
 CuO_2Se See Copper selenate.
 $\text{CuO}_2\text{P}_2\text{U}_2 + 8\text{H}_2\text{O}$ See Meta-torbernite.
 CuS , See Copper Oxides.
 CuSn , 926².
 $\text{Cu}_2\text{Fe}_2\text{Sn}$ See Stannite.
 Cu_2I_2 See Copper iodide.
 Cu_2Mg , 2014².
 Cu_2O See Copper oxides; Cuprite.
 Cu_2O_2 See Copper oxides.
 Cu_2S See Chalcocite; Copper sulfides.
 Cu_2Sb , 1687², 3226².
 Cu_2Te , 3226².
 $\text{Cu}_2\text{H}_2\text{O}_8$ See Antlerite.
 $\text{Cu}_2\text{La}_2\text{Nd}_2\text{O}_{16} + 24\text{H}_2\text{O}$, 2174².
 $\text{Cu}_2\text{N}_2\text{Nd}_2\text{O}_{16} + 24\text{H}_2\text{O}$, Copper neodymium nitrate, 2309².
 $\text{Cu}_2\text{N}_2\text{O}_2\text{Pr}_2 + 24\text{H}_2\text{O}$, Copper praseodymium nitrate, 2309².
 $\text{Cu}_2\text{N}_2\text{O}_2\text{Sm}_2 + 24\text{H}_2\text{O}$, Copper samarium nitrate, 2309².
 $\text{Cu}_2\text{O}_2\text{S} + 2\text{H}_2\text{O}$ See Antlerite.
 Cu_2Sn , 926², 2627².
 $\text{Cu}_2\text{O}_2\text{S}$, 788².
 Cu_2Sn , 926², 2627².
 Cu_2Sn_2 , 2627².
 $\text{Cu}_2\text{O}_2\text{S}_2 + 7\text{H}_2\text{O}$, 100².

Dy_2O_3 See Dysprosium oxide.

ErN See Erbium nitride.

Er_2O_3 See Erbium oxide.

Eu_2O_3 See Europium oxide.

FH See Hydrofluoric acid.

FLi See Lithium fluoride.

FNa See Sodium fluoride.

FRb See Rubidium fluoride.

FTl See Thallium fluoride.

FHK See Potassium fluoride.

FH_2 See Hydrofluoric acid.

FMg See Magnesium fluoride.

$\text{F}_2\text{O}_2\text{Er}_2$, 2609².

F_2S See Sulfur fluoride.

F_2Sr See Strontium fluoride.

$\text{F}_2\text{H}_2\text{MoN}_2\text{O}_3$ Ammonium oxytungmolybdate, 1359².

F_2La See Lanthanum fluoride.

$\text{F}_2\text{V} + 3\text{H}_2\text{O}$, 2174².

F_2Si See Silicon fluoride.

F_2Ru See Ruthenium fluoride.

$\text{F}_2\text{FeH}_2\text{N}_2$ Ammonium fluoerrate, 1359².

$\text{F}_2\text{H}_2\text{Si}$ See Fluosilicic acid.

$\text{F}_2\text{H}_2\text{HfN}_2$, 1070², 2155².

$\text{F}_2\text{H}_2\text{N}_2\text{Zr}$, 1070², 2155².

F_2HfK_2 , 2155².

$\text{F}_2\text{K}_2\text{Si}$ See Potassium fluosilicate.

$\text{F}_2\text{K}_2\text{Zr}$, 2155², 3180².

F_2MgSi See Magnesium fluosilicate.

$\text{F}_2\text{Na}_2\text{Si}$ See Sodium fluosilicate.

$\text{F}_2\text{H}_2\text{HfN}_2$, 2155².

$\text{F}_2\text{H}_2\text{N}_2\text{Zr}$, 2155².

FeH_2O_2 See Iron hydroxides.

FeH_2O_2 See Iron hydroxides.

$\text{FeH}_2\text{N}_2\text{O}_8\text{S}_2$ Ammonium iron sulfate, 1519², 2443².

$\text{FeH}_2\text{N}_2\text{O}_8\text{S}_2 + \text{H}_2\text{O}$, 616².

$\text{FeH}_2\text{N}_2\text{O}_8\text{S}_2$, 1232².

$\text{FeH}_2\text{N}_2\text{O}_8$, 1232².

$\text{FeH}_2\text{N}_2\text{O}_8\text{S}_2$, 1232².

FeI_2 See Iron iodide.

$\text{FeNO}_2\text{Se} + 4\text{H}_2\text{O}$, 941².

FeO See Iron oxides.

FeO_2Si See Grünerite.

FeO_2Ti See Ilmenite.

$\text{FeO}_2\text{P} + 2\text{H}_2\text{O}$ See Strengite.

FeO_2S See Iron sulfates.

$\text{FeO}_2\text{Se} + 5\text{H}_2\text{O}$, 941².

FeO_2Ta See Tantalite.

FeS See Iron sulfides; Troilite.

FeS_2 See Iron sulfides; Marcasite; Melnikovite; Pyrite.

FeSe See Iron selenide.

$\text{Fe}_2\text{H}_2\text{O}_2\text{P} + 5\text{H}_2\text{O}$ See Caxoxenite.

$\text{Fe}_2\text{MgO}_2\text{Sb}_2 + 4\text{H}_2\text{O}$ See Iddingsite.

$\text{Fe}_2\text{NO}_2\text{S}_2 + 13\text{H}_2\text{O}$, 940².

Fe_2Ni , 2773².

Fe_2O_2 See Goethite; Hematite; Iron oxides; Lepidocrocite.

$\text{Fe}_2\text{O}_2\text{Si}$ See Fayalite.

$\text{Fe}_2\text{O}_2\text{S}_2$ See Iron sulfates.

Fe_2Si , 3470².

$\text{Fe}_2\text{H}_2\text{KO}_2\text{S}_2$ See Jarosite.

Fe_2N_2 Iron nitride, 448².

Fe_2Ni_2 , 2773².

Fe_2O_2 See Magnetite.

$\text{Fe}_2\text{O}_2\text{S}_2 + 12\text{H}_2\text{O}$ See Roemerite.

$\text{Fe}_2\text{O}_2\text{Pb}$ See Ferroplyumbite.

$\text{Fe}_2\text{O}_2\text{S}_2 + \text{aq}$. See Copiapite.

$\text{Fe}_2\text{H}_2\text{O}_2\text{P}_2$ See Beraunite.

$\text{Fe}_2\text{O}_2\text{Sb}_2\text{Si}_2 + 2\text{H}_2\text{O}$ See Chapmanite.

GaH_2O_2 See Gallium hydroxide.

$\text{Ga}_2\text{O}_2\text{S}_2$ See Gallium sulfate.

Gd_2O_2 See Gadolinium oxide.

GeH_2 See Germanium hydride.

GeO_2 See Germanium oxide.

HI See Hydroiodic acid.

HIO_2 See Hypiodous acid.

HIO_3 See Iodic acid.

HKO See Potassium hydroxide.

- $\text{H}_2\text{N}_2\text{O}_2$ Hydroxylamine disulfonic acid, di-K salt, 2176.
 $\text{H}_2\text{N}_2\text{O}_2$ See Potassium phosphates.
 $\text{H}_2\text{N}_2\text{O}_2$, 1997.
 H_2N_2 See Lithium hydride.
 H_2O See Lithium hydroxide.
 H_2O_2 See Lithium hydrosulfide.
 H_2O_2 See Potassium acid.
 H_2O (See also Hyponitrous acid.) Nitramine, 944.
 H_2O_2 See Nitrous acid.
 H_2O_2 See Nitric acid.
 H_2O_2 See Pernitric acid.
 H_2O_2 , 1998.
 H_2N See Hydrazoic acid.
 $\text{H}_2\text{N}_2\text{O}$ Hydrogen hyponitride, 2311.
 $\text{H}_2\text{N}_2\text{O}$ See Sodium hydroxide.
 $\text{H}_2\text{N}_2\text{O}_2$ See Sodium sulfides.
 $\text{H}_2\text{N}_2\text{O}_2$ See "NaSH" under Alkali metal hydro-sulfides; Sodium hydrosulfide.
 $\text{H}_2\text{N}_2\text{O}_2$ See Sodium phosphates.
 H_2O_2 See Rubidium hydroxide.
 H_2O_2 See Tetrameric acid.
 $\text{H}_2\text{N}_2\text{O}_2 + 5\text{H}_2\text{O}$, 1385.
 $\text{H}_2\text{N}_2\text{O}_2 + 5\text{H}_2\text{O}$, 1385.
 H_2N_2 See Potassium amide.
 $\text{H}_2\text{N}_2\text{O}_2$, 1997.
 $\text{H}_2\text{N}_2\text{O}_2$ Potassium ammonomolybdate, 2920.
 $\text{H}_2\text{N}_2\text{O}_2$ Potassium ammonotungstate, 2920.
 $\text{H}_2\text{K}_2\text{O}_2$, 2609.
 H_2MgO_2 See Magnesium hydroxides.
 H_2MgO_2 See Magnesium sulfides.
 H_2MnO_2 See Manganese hydroxides.
 H_2MoO_2 See Molybdic acid.
 H_2NNa See Sodium amide.
 H_2NNaO_2 Hydroxylaminesulfonic acid, Na salt, 2177.
 H_2NO_2 , 1998.
 H_2N_2 Dinitride, 2312.
 $\text{H}_2\text{N}_2\text{O}_2$ (See also Hyponitrous acid.) Nitramine, 430.
 $\text{H}_2\text{N}_2\text{O}_2$ See Nickel hydroxides.
 H_2O See Water.
 H_2O_2 See Hydrogen peroxide.
 H_2O_2 See Lead hydroxide.
 H_2O_2 See Tin acids.
 H_2O_2 See Strontium hydroxide.
 H_2O_2 See Sulfuric acid.
 H_2O_2 See Selenious acid.
 H_2O_2 See Silicic acid.
 H_2O_2 Silicane, 1670.
 H_2O_2 See Tin acids.
 H_2O_2 See Thionic acid.
 H_2O_2 See Osmic acid.
 H_2O_2 See Sulfuric acid.
 H_2O_2 See Hyposulfurous acid.
 H_2O_2 See Selenic acid.
 H_2O_2 See Tungstic acid.
 $\text{H}_2\text{O}_2\text{SiZn}$ See Calamine.
 H_2O_2 , 941.
 H_2O_2 See Dithionic acid.
 H_2O_2 See Pentathionic acid.
 H_2O_2 , 941.
 H_2O_2 See Persulfuric acid.
 H_2Po See Polonium hydride.
 H_2S See Hydrogen sulfide.
 H_2Sb See Antimony hydride.
 H_2Sb See Hydrogen selenide.
 $\text{H}_2\text{O}_2\text{Si}$ Siloxene, triiodo-, 619.
 $\text{H}_2\text{K}_2\text{O}_2$, 2178.
 $\text{H}_2\text{K}_2\text{O}_2$, 2178.
 H_2MnO_2 See Manganese hydroxide.
 H_2N See Ammonia.
 H_2N_2 See Hydrazylamine.
- H_2NO Ammonia, dihydroxy-, 944.
 H_2NO_2 Sulfamic acid, 793.
 H_2NO_2 Hydroxylamine isomono-sulfonic acid, 3249.
 Hydroxylaminesulfonic acid, 2176, 2177.
 H_2NO_2 , 1997.
 H_2NO_2 Hydroxylamine disulfonic acid, 1997, 2176.
 Hydroxylamine disulfonic acid, 2176.
 H_2NO_2 , 1997.
 $\text{H}_2\text{NO}_2\text{S}_2$ Hydroxylaminetrisulfonic acid, 2176.
 $\text{H}_2\text{NO}_2\text{Pb}_2\text{S}_2 + 3\text{H}_2\text{O}$, 2176.
 H_2NiO_2 See Nickel hydroxides.
 $\text{H}_2\text{NiO}_2\text{P}_2 + 3\text{H}_2\text{O}$, 2920.
 $\text{H}_2\text{O}_2\text{P}$ See Hypophosphorous acid.
 $\text{H}_2\text{O}_2\text{P}$ See Phosphorous acid.
 $\text{H}_2\text{O}_2\text{P}$ See Phosphoric acid.
 H_2P See Phosphine.
 H_2Sb See Stibine.
 H_2IN See Ammonium iodide.
 $\text{H}_2\text{LaNO}_2\text{S}_2 + 4\text{H}_2\text{O}$ Ammonium lanthanum sul-fate, 2582.
 $\text{H}_2\text{MgNO}_2\text{P}$ Ammonium magnesium phosphate, 797.
 $\text{H}_2\text{NNO}_2\text{S}_2 + 4\text{H}_2\text{O}$ Ammonium neodymium sulfate, 2582.
 $\text{H}_2\text{NO}_2\text{S}_2\text{Ti} + 4\text{H}_2\text{O}$ Ammonium thallium sul-fate, 2582.
 H_2N_2 See Hydrazine.
 $\text{H}_2\text{N}_2\text{O}$ See Ammonium nitrite.
 $\text{H}_2\text{N}_2\text{O}$ See Ammonium nitrate.
 $\text{H}_2\text{N}_2\text{O}_2$ Hydrazine sulfonic acid, 945.
 $\text{H}_2\text{O}_2\text{Sn}$ See Tin acids.
 $\text{H}_2\text{O}_2\text{Th}$ See Thorium hydroxide.
 $\text{H}_2\text{O}_2\text{Si}$, 941.
 H_2Pb See Lead hydride.
 H_2Sn See Tin hydride.
 $\text{H}_2\text{IO}_2\text{Si}$ Siloxene, iodo-, 10, 618.
 H_2NO See Ammonium hydroxide.
 $\text{H}_2\text{O}_2\text{Si}$ See Siloxene.
 $\text{H}_2\text{O}_2\text{Si}$ Siloxene, hydroxy-, 618.
 $\text{H}_2\text{O}_2\text{Si}$ Siloxene, trihydroxy-, 618.
 $\text{H}_2\text{O}_2\text{Si}$ Siloxene, hexahydroxy-, 618.
 $\text{H}_2\text{NO}_2\text{Si}$ Siloxene, amino-, 618.
 $\text{H}_2\text{MnNO}_2\text{O}_2$ Ammonium manganese iodate, 1385.
 $\text{H}_2\text{MgNO}_2\text{S}_2$ Ammonium magnesium sulfate, 2443, 3393.
 H_2MoNO_2 See Ammonium molybdates.
 $\text{H}_2\text{NO}_2\text{S}_2$ See Ammonium sulfate.
 $\text{H}_2\text{NO}_2\text{S}_2$ See Ammonium selenate.
 $\text{H}_2\text{NO}_2\text{S}_2$ See Ammonium disulfate.
 $\text{H}_2\text{N}_2\text{S}_2$ See Ammonium sulfide.
 $\text{H}_2\text{N}_2\text{S}_2$ Ammonium pentasulfide, 967.
 $\text{H}_2\text{NO}_2\text{Th}$ Ammonium thorium sulfate, 425.
 $\text{H}_2\text{O}_2\text{SiW}_2 + 5\text{H}_2\text{O}$ Silicododecatungstic acid, 792.
 $\text{H}_2\text{O}_2\text{P}$ See Ammonium phosphates.
 $\text{H}_2\text{NO}_2\text{Si}$ Siloxene, iodo-, 10, 618.
 $\text{H}_2\text{NO}_2\text{O}_2$, 2609.
 $\text{H}_2\text{NO}_2\text{P}_2$, 2178.
 $\text{H}_2\text{MoNO}_2\text{O}_2$ See Ammonium molybdates.
 H_2Hg See Mercury halides.
 H_2O See Hafnium oxide.
 HgI See Mercury iodides.
 HgI See Mercury iodides.
 HgHg , 208.
 HgNO_2 See Mercury nitrates.
 HgO See Mercury oxides.
 HgS See Cinnabar; Mercury sulfides; Metacinnabarite.
 HgI See Mercury iodides.
 HgI_2O_2 , 787.

$Hg_2I_2N_2O_4$, 787. Hg_2Mg , 2081. Hg_2MnS , Manganese mercury sulfide, 622^a. $Hg_2I_2K_2$, Potassium iodomercurate, 1978^a. HO_2O , See Holmium oxide.

I, See Potassium iodide.

IKO, See Potassium iodate.

IKO, See Potassium periodate.

ILi, See Lithium iodide.

IMoNa₂O₂, Sodium molybdoperiodate, 2307².IN, Hydrazoic acid, iodo-, 253^a.

INa, See Sodium iodide.

INaO, See Sodium iodate.

IRb, See Rubidium iodide.

ITI, See Thallium iodide.

 $I_2Mn_2O_{11} + 2H_2O$, 1385^a. $I_2MgMn_2O_{12} + 3H_2O$, 1385². $I_2MgMn_2O_{11} + 3H_2O$, 1385². $I_2Mn_2Na_2O_{11} + 3H_2O$, 1385². $I_2Mn_2Na_2O_{12} + 2H_2O$, 1385². $I_2Mn_2O_{11}Pb + 3H_2O$, 1385². $I_2Mn_2O_{11}Sr + 3H_2O$, 1385². $I_2Mn_2O_{11}Zn + 4H_2O$, 1385². $I_2Mn_2O_{11}Pb + 2H_2O$, 1385². $I_2Mn_2O_{11}Sr + 4H_2O$, 1385².

IPb, See Lead iodide.

ISn, See Tin iodides.

IN, See Nitrogen iodide.

IPSe, 3069². $I_2K_2Mn_2O_{14} + 3H_2O$, 1385². $I_2Mn_2O_{11}Zn_2 + 7H_2O$, 1385².

ISn, See Tin iodides.

ITI, See Titanium iodide.

 $I_2K_2Mn_2O_{14}$, Manganese potassium iodate, 1385². $IMn_2O_{11}Rb$, Manganese rubidium iodate, 1385².IPSe, 3069². I_2K_2Te , Potassium iodotellurite, 1473². $IMn_2O_{11}Rb$, Manganese rubidium iodate, 1385².

IRO, See Iridium oxides.

IROs, See Iridosmine.

KLISO, Lithium potassium sulfate, 2764².

KMnO, See Potassium permanganate.

KNO, See Potassium nitrate.

 $KO_2UV + H_2O$, See Carnotite. $K_2Li_2O_2W$, Lithium potassium tungstate, 1827¹. K_2MgO_2S , Magnesium potassium sulfate, 3201². K_2MnO_2S , Manganese potassium sulfate, 2608^a. $K_2Mn_2O_{11}S$, (See also Manganolangebeinite.) 943², 2623². K_2NO_2S , Nitrososulfonic acid, K salt, 2177¹.Sulfazalinic acid, K salt, 2177¹. $K_2N_2O_2S$, 943². $K_2Nd_2S_2O_{18} + 2H_2O$, 2309². K_2O_2S , See Potassium sulfate. K_2O_2S , See Potassium sulfite. K_2O_2Se , See Potassium selenate. K_2O_2W , See Potassium tungstate. K_2O_2S , See Potassium metabisulfite. K_2O_2S , Potassium tetrathionate, 1105^a. K_2O_2S , See Potassium persulfate. K_2S , See Potassium sulfide. K_2S , Potassium pentasulfide, 464². K_2NO_2S , Hydroxylamineisodisulfonic acid, tri-K salt, 2176^a. K_2NO_2S , Potassium nitrosulfonate, 3227^a. $K_2NO_{10}S$, Hydroxylaminetrisulfonic acid, tri-K salt, 2176². K_2O_2P , See Potassium trimetaphosphate. $K_2O_{12}P_4$, See Potassium tetrametaphosphate. $K_2La_2O_{11}S$, + $2H_2O$, 2309². $K_2Nd_2O_{11}S$, + $2H_2O$, 2309². $K_2Nd_2O_{11}S$, + $8H_2O$, 2309². $K_2O_{12}P_4$, See Potassium hexametaphosphate. $K_2La_2O_{11}S$, + H_2O , 2309². $K_2Nd_2O_{11}S$, + $10H_2O$ and $2H_2O$, 2309². $K_2La_2O_{11}S$, + $2H_2O$, 2309². $K_2Nd_2O_{11}S$, + $2H_2O$, 2309². $K_2O_{12}Ta_{10}S$, + $24H_2O$, 2307¹. $K_2La_2O_{11}S$, + $4H_2O$, 2309². $La_2O_{11}S$, See Lanthanum sulfate. $La_2O_{11}S, Ti_2 + 2H_2O$, 2920^a. $La_2O_{11}S, Ti_2$, 2920^a.

LiMnO, See Lithium permanganate.

LiNO, See Lithium nitrate.

LiO, See Lithium oxide.

LiO₂S, See Lithium sulfate.LiO₂Se, See Lithium selenate.LiO₂W, See Lithium tungstates.LiO₂W₂, See Lithium tungstates.

LiS, See Lithium sulfides.

 $Li_2O_{12}Ta_{10}S$, + $40H_2O$, 2307².Lu₂O₃, See Lutetium oxide. $MgNa_2O_2S$, + $6H_2O$ Magnesium sodium sulfate, P 2864^a.

MgO, See Magnesia.

MgO₂, See Magnesium oxides.MgO₂S, See Magnesium sulfite.MgO₂S, See Epsomite; Kieserite; Magnesium sulfate. $MgO_{11}Si_2U_2 + 7H_2O$, See Sklodowskite.

MgS, See Magnesium sulfide.

 $MgZn_2$, 207^a, 3469², 3470². Mg_2Pb , 3180^a. Mg_2Si (See also Magnesium silicide.) 3241^a, 3469^a. Mg_2Sn , 925^a, 3180^a.MnN₂O, See Manganese nitrate. $MnNa_2O_2Pb$, See Plumboxan.

MnO, See Manganese oxides.

MnO, See Manganese oxides.

 MnO_2Rb , See Rubidium permanganate. MnO_2S , See Manganese sulfate. MnO_2Se , See Manganese selenate.

MnS, See Manganese sulfides.

MnS, See Manganese sulfides.

 $Mn_2O_2Si_2 + H_2O$, See Inesite. Mn_2O_2Si , See Braunitz.MoNi, 2592^a. $MoNiSi_2$, 2592^a.

MoO, See Molybdenum oxides.

 MoO_2S , 2311^a.

MoO, See Molybdenum oxides.

MoS, See Molybdenite.

MoS, See Molybdenum sulfide.

 $MoSi_2$, 2592^a. $MoSi_2$, 2592^a. $Mo_2Ni_2Si_2$, 2592^a. Mo_2O_2 , See Molybdenum oxides. Mo_2O_2S , + 5 or $6H_2O$ Molybdenum oxysulfate, 20^a.

NNaO, See Sodium nitrile.

NNaO, See Sodium nitrate.

 $NNa_2O_2S + H_2O$, See Dapaskil.

NO, See Nitrogen oxides.

NO, See Nitrogen oxides.

NS, See Nitrogen sulfides.

NSc, See Scandium nitride.

NSi, See Silicon nitride.

NTa, See Tantalum nitride.

NTi, See Titanium nitride.

NV, See Vanadium nitride.

Nzr, See Zirconium nitride.

 N_2Na_2O , Sodium hyponitrite, 1

O₅Se See Selenium oxides.
 O₅Si See Citrine; Cristoballite; Silice.
 O₅Sn See Tin oxides.
 O₇Te See Tellurium oxide s.
 O₇Th See Thorianite; Thorium oxides.
 O₇Ti See Anatase; Rutile; Titanium oxides.
 O₇U See Bröggerite; Uraganite; Uranium coxides.
 O₁W See Tungsten oxides.
 O₂Zn See Zinc oxides.
 O₂Zr See Zirconium oxides.
 O₂Pf See Phosphorus oxides.
 O₂Pb: See Lead oxides.
 O₂S See Sulfur trioxide.
 O₂Sb: See stimonite oxide.
 O₂Sc: See Scandium oxide.
 O₂Sm: See Samarium oxide.
 O₂Tb: See Terbium oxide.
 O₂Tl: See Thallium oxides.
 O₂Tm: See Thulium oxide.
 O₂V: See Vanadium oxides.
 O₂W See Tungsten oxides.
 O₂Yb: See Ytterbium oxide.
 O₂Yt: See Yttrium oxide.
 O₂Os See Osmium oxides.
 O₂PbS See Lead sulfate.
 O₂PbSe See Lead selenate.
 O₂Pb: See Lead oxides.
 O₂Ra: See Radium sulfate.
 O₂RbS: See Rubidium sulfate.
 O₂RbSe: See Rubidium selenate.
 O₂Ru: See Ruthenium oxide.
 O₂Sr: See Strontium sulfate.
 O₂St: See Thallium sulfate.
 O₂Zn: See Zinc sulfate.
 O₂SeSr: See Strontium selenate.
 O₂SeZn: See Zinc selenate.
 O₂SiZn: See Zinc silicate.
 O₂SiZr: See Zircon.
 O₂V: See Vanadium oxides.
 O₂P: See Phosphorus oxides.
 O₂Ta: See Tantalum oxide.
 O₂U + H₂O See Becquerelite.
 O₂V: See Vanadium oxides.
 O₂W: See Tungsten oxides.
 O₂U Uranyl sulfate, 943¹, 2453¹.
 + 6H₂O See Zeppelite.
 O₂Tb: See Terbium oxides.
 O₂Ti: See Titanium sulfate.
 O₂U + 4 and 8H₂O Uranium sulfate, 943¹.
 O₂Zr See Zirconium sulfate.
 O₂U: See Uranium oxides.
 O₂Pr: See Praseodymium oxide.
 O₂ThTh: + 4H₂O Thallium thorium sulfate, 2175¹.
 O₂Yt: See Yttrium sulfate.
 O₂PbPbU + 6H₂O See Dammite.
 O₂ThThZr + 4H₂O Thallium zirconium sulfate, 2175¹.
 O₂ThThZr: + 8H₂O Thallium zirconium sulfate, 2175¹.
 O₂TeThYt: + 6H₂O Tellurium yttrium sulfate, 220¹.
 O₂ThThTh: Thallium thorium sulfate, 2175¹.
 O₂ThThZr: 2175¹.
 PbS: See Phosphorus sulfides.
 PbS See Galena; Lead sulfide.
 Pb₂: See Lead sulfides.
 PbSe See Clausthalite.
 PbTe See Arsenite.
 PbTl: 2803¹.
 Pb₂Sb: See Jamesonite.

Pb_2SnSb_4 See *Boulangerite*.

PdSe See *Palladium selenide*.

PtSe_2 See *Platinum selenide*.

Sn See *Tin sulfides*.

ThS See *Thallium sulfide*.

W See *Tungsten sulfide*.

Zn See *Sphalerite*; *Zinc sulfide*.

Si See *Silicon sulfide*.

Sn See *Tin sulfides*.

Zr See *Zirconium sulfide*.

S_2Sb_2 See *Antimonite*; *Antimony sulfide*.

S_2Sb_2 See *Antimony sulfides*.

SbSn , 1687¹.

SbZn , 2162¹.

Sb_2Zn_2 , 2162¹.

SeSr See *Strontium selenide*.

SeZn See *Zinc selenide*.

Se_2Zr See *Zirconium selenide*.

TeZn See *Zinc telluride*.

Pb_2SnSb_4 See *Boulangerite*.

PdSe See *Palladium selenide*.

PtSe_2 See *Platinum selenide*.

Sn See *Tin sulfides*.

Tl_2 See *Thallium sulfide*.

W See *Tungsten sulfide*.

Zn See *Sphalerite*; *Zinc sulfide*.

Si See *Silicon sulfides*.

Sn See *Tin sulfides*.

Zr See *Zirconium sulfide*.

S_2Sb_2 See *Antimonite*; *Antimony sulfide*.

S_2Sb_2 See *Antimony sulfides*.

SbSn , 1687°.

SbZn , 2162°.

Sb_2Zn_3 , 2162°.

SeSr See *Strontium seleniae*.

SeZn See *Zinc selenide*.

Se_2Zr See *Zirconium selenide*.

TeZn See *Zinc telluride*.